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EDITORIAL NOTES—GAS, &c.

Principles and Practices under Examination.

As was pointed out last week, in the article which introduced this subject, M. Sainte-Claire Deville, whose views on questions referring to the carbonization of coal for the production of gas must always be treated with respect, though not necessarily always accepted as conclusive, takes exception to the theory of the German engineers that the gas evolved from coal in the process of carbonization in the intermittently fed vertical retort takes its course through the cool and uncarbonized part of the charge. The considerations M. Deville applies to his opposing theory have unfortunately for their acceptance not the confirming practical experience nor the characteristics of continuous and repeated result in different works that the exponents of the vertical retort system have to offer. When first there came intelligence that so much of the good effect of carbonizing in the intermittently charged vertical retorts was due to this comparatively cool passage through the charge for the greater part of the gas produced, it was looked upon with scepticism. But M. Deville now apparently overlooks the fact that, apart from the Dessau vertical retort, there has been the substantiating evidence advanced by Mr. W. R. Herring in charging inclined retorts solid, by way of trial, and by Mr. G. R. Love in similarly treating retorts set at an angle of 45°. It was not practicable for Mr. Herring to continue to charge his 32° inclined retorts full; but during the trial made for personal satisfaction, he was able to reproduce—anyway in part—the effects of the carbonization in Dessau vertical retorts, and found that the gas did take the path of least resistance, and that path was along the least carbonized portion of the charge. From the premises he lays down, M. Deville deduces that the gas passes more easily through the cracked and fissured pieces of coke than through the thick mass of coal; that travelling through the fissures of the coke, the volatile products are subject to the decomposing action of the high temperature; and that the gas has a tendency to pass to the extreme outside of the charge, and make exit up the sides of the retort. He appears to found his hypothesis on two main points—one that the density of the coke is due to the carbon resulting from the decomposition of the volatile products from the gas being deposited in the pores of the coke, and the other that the steam which is ultimately passed through the retort, making its way by preference along the walls of the retort, gives the coke in contact with the surface a mammillated and fissured appearance identically the same as in the case of the coke which comes in contact with the floor of the horizontal retort. In regard to the former theory, M. Deville gives no credit, for the greater density of the coke, to the packing of the retort full; and the latter theory obviously suffers a little weakness in that in the horizontal retort, with the free space at the top, the same conditions of gas discharge and travel cannot possibly obtain along the floor of the retort on which the charge reposes as are represented by the conditions existing in a vertical retort charged completely full. If the conditions are not precisely alike, the mammillated and fissured effect, if the same (it is a new point not yet particularly inquired into), must be due to some other or different cause.

We quite appreciate what M. Deville has to say regarding the pressures in the lower part of the Dessau vertical retort, and their decrease as the belt of the carbonized charge increases and the central core diminishes, though he does not give much credit to the provision for the charging into each retort of separate grades of coal in respect of size for the very purpose of relieving this pressure. As a piece of *a priori* reasoning, what he says is good. But the fact remains that, if there was this exposure of the gas to the highly incandescent coke and to the large circumferential surface of the vertical retort, the evils of surface contact and exposures to high temperatures in horizontal retorts would be intensified, not mitigated, in verticals as product results and analyses show them to be. M. Deville's hypotheses and deductions do not explain why, though high temperatures are employed, naphthalene does not disclose its unwelcome presence, nor does he show why there is a marked decrease of carbon bisulphide, nor a reduction of cyanogen compounds, nor an increase of ammonia. It is impossible to set aside a rational cause of effects for even the reasoning of such an authority as M. Deville, unless he can advance some reasonable explanation as to how those very agreeable effects to the gas maker are realized by the Dessau retort. They are effects the very opposite of those that would be expected if M. Deville was correct in his supposition.

Turning now to the Munich inclined carbonizing chambers, a record of progress has been made. The results that Herr Reis presented at the last meeting of the German Association are a marked advance upon those that he published twelve months previously—in fact, the results show quite a respectable jump. In the table published subsequent to his paper (see "JOURNAL," June 30, p. 927), it is seen that the average temperature of the Munich carbonizing chambers is stated to be lower than that employed in the Dessau vertical settings; while the make of gas with different coals runs from 200 to 1000 cubic feet higher. The makes given in the table for the vertical retorts are, however, without the admission of steam, but some are quoted in the remarks at the foot of the table, which show that, with the admission of steam, the makes are about level (using different mixtures of coal) with those of the carbonizing chambers. There is not much to choose between the calorific power results of the two systems, though those from the verticals are generally rather higher. The yield of ammonia is about the same; but the production of tar with the chambers is not so high as in the vertical retort. We are looking to the publication, after a year's working, of the results from the larger installation that has been erected in Hamburg, and from the new and larger installation at Munich. Already the appetites of gas engineers for knowledge has been whetted by the article on the Hamburg settings, by Dr. Lessing, in our issue for July 14, in which he stated that the guarantee of the contractors as to a make of 175,000 cubic feet from a charge of 17½ tons in twenty-four hours in a setting of three chambers has, in a short trial run, been exceeded by 25,000 cubic feet. Trial runs are very frequently found to give fugitive results; so that, before reliance is placed on these returns, it will be well to have the confirmation of working results over a long period. There are several points of information still absent regarding the Munich chambers; and one is the cost of construction and equipment. The heavier charges—17½ tons for a set of three chambers—to be dealt with, the great bulk of coke to be treated on its exit from the chambers, and the capacity of the chambers, all suggest somewhat heavy capital expenditure, regarding which no complete information is yet available.

These general observations on the chambers bring us to an interesting point of criticism, which applies as much (perhaps even more so) to the bye-product coke-ovens that are strongly recommended by those interested in them for use in gas-works, as to the Munich chambers. The duration of carbonization in the Munich chambers is 24 hours, and they are charged part in the morning and part in the evening; so that only one man need remain during the night to attend to the fires. The sole recommendation, so far as can be seen at present, is this one of the almost complete absence of night labour and the reduced labour on the men during the daytime. This, however, is a point that can be over-done, as a study of the profitable employment of the men will show. Against it so far as can be suggested at present are the capital expenditure, the nuisance arising from dealing with large charges of coal and large bulks of

coke (for the latter special quenching provision has to be made), and the want of uniformity in the quality of the gas evolved over the twenty-four hour period of carbonization. About the two former points not much is known at present; about the last one, criticism has been made by Dr. Bueb and by Herr Körting. It seems to be a weak point of the system. Dr. Bueb has suggested that costly arrangements would have to be made to ensure a uniform mixture of the gas evolved at different periods of carbonization. But Herr Reis asserts that the objection is groundless—the mixing taking place in the gasholder in a short time, and with care in the filling of the holders a uniform gas is obtained for distribution. It would be interesting to learn more about the extra "care" that is requisite for this purpose. It is now many years ago that the late Mr. Frank Livesey directed attention to the question of the stratification of gases in gas-holders; and it would be instructive, now that the question is raised again by bulk carbonization, to have the matter investigated at Hamburg or Munich. Herr Körting, too, contends that it is only by the old and well-tried practice of distributing the periods of charging, that gas of uniform quality can be obtained; and at Cologne, with the vertical retorts, Herr Prenger has found that, by changing the practice from charging half the vertical retorts every six hours to a quarter of the retorts every three hours, he obtains a fairer equalization of result as well as a tolerably uniform calorific power.

If the criticism conveyed here applies to the Munich carbonizing chambers, they apply with even greater force to coke-ovens. Notwithstanding all that was said by Herr Peters in his paper on the Koppers ovens (*ante* p. 232) as to their favourable features for the gas maker, we cannot get away from the fact that their primary object is the production of coke of a character which would be a positive nuisance in a district where the demand was for any other than metallurgical or other suitable industrial purposes. Mr. Forbes Carpenter was recently cautioning us, too, against the nuisance that would arise from the charging of such large bulks of coal, and discharging and quenching such large bulks of coke, in the situations in which most urban gas-works exist to-day. The point can also be made that, however good the result, carbonization in bulk could have but limited application, owing to the fluctuation of demand on most gas-works; and Herr Körting points, on information received, to the serious variations of the heating value of the gas yield from bulk carbonization over long periods. The yield results that are given in the paper on the Koppers ovens do not show any results superior to those that are obtained by the modern practices and developments in smaller charge carbonization. The claims of superiority, in short, are not in any way substantiated.

Truly, there is no end to the interest that is to be extracted from the views of opposing intelligence, not only favourable but impartial towards modern developed carbonizing systems. Part of it we have endeavoured to set forth in these two articles; but that part is only *exempli gratiâ*.

An Explanation Required.

What at first looked like an alarming report comes from Paris; and if experience in this country had not produced a solid amount of confidence, there would have been a drooping of the hope among us that the dressing of the surfaces of roads with tar was going to improve the value of that plentiful bye-product of gas manufacture, and simultaneously give relief from an insufferable nuisance along our highways. It is reported by the Paris correspondent of the "Daily Tele-"graph" that the City of Paris has decided to give up tar for the avenues within its boundaries. It is fully admitted that the surfacing of the roads with tar lays dust excellently; but according to the gardeners of the city it presents serious drawbacks. There is something dogmatic in what follows, but the very dogmatism exhibits a complete belief in the truth of the statement on the part of the correspondent of our morning contemporary. "Tar steadily and rapidly kills "vegetation. Trees lining tarred roads all die off in a short "space of time." Then follows the story of a phenomenal experience. An experiment has been made with tar in the Avenue du Bois de Boulogne; and it has proved disastrous. The road was tarred four months ago; and the dust, which had been intolerable before, was successfully laid. "But "the fine particles of tar thrown up by passing vehicles have "ruined vegetation. Seven of the finest trees along the "avenue have been killed in the above space of time, and "have had to be cut down. The flower beds and the grass "plots suffer even more; and the upkeep of the former is "now ruinous for the city."

This is a dismal picture of the consequences of using tar; but how comes it that the tar is in such a state of fluidity on the road surface that "fine particles" are thrown up in the way suggested? The "discovery" of the drawback is indeed unfortunate. But why has it not been discovered before? This experiment is only of four months' duration; four and more years' experience in this country has not produced any such mischief. This fact points to the possibility of remedy; and that the advantage of the most efficacious means of suppressing the dust nuisance, and at the same time of preserving road surfaces, may yet be continued in the city. Success is all a question of the process adopted in applying the tar to the surface of the roads, as was pointed out by Sir George Livesey when a motorist complained, at the recent meeting of the South Suburban Gas Company, of the baneful effect that tar—if not properly applied to the roads—has upon the tyres of motor cars. There will be no fine particles of tar flying about if it is put on the roads in the fashion approved by long experience; and vegetation, flowers, and grass plots will not then suffer as they have done, and be made hideous as they have been, through the coating of dust that they have received in days past through the disintegrating and disturbing influences of the swift passage of motor cars over the road surfaces. Perhaps the City of Paris will before long see that, in condemning tar, there has been an egregious blunder. At the forthcoming International Road Congress in Paris, the question of road-tarring is to receive prominence; and the Paris experience will, we believe, then be found to be an isolated one. If it does not satisfy, we would suggest that a deputation should be sent to this country by the Minister of Public Works, to examine the trees, flowers, and vegetation generally bordering some of our tarred roads. The main road along the sea front at Eastbourne might, for example, be inspected. The road is tarred. The flower beds, the trees, and the celebrated lawns are, during the summer months, a perfect picture and a pleasure. No fine particles of tar have a deteriorating influence there. We ask the public gardeners of Paris and those responsible for the roadways, Why this difference? In the reply should be the remedy.

Three-Feet Deep Retorts.

It has been known that for many months past Mr. Thomas Glover, of Norwich, has been directing his attention to the carbonization of coal in quantities intermediate between the present practice in gas-works and that in coke-oven operation, but with weights having closer relationship with the former than with the latter. To-day it is our pleasure to publish an abstract of the complete patent specification of Mr. Glover's plans; and it affords another opportunity of saying a word in praise of the fraternal endeavours that are being made under the patronymic of this inventor towards elucidating problems in carbonization primarily for gas production and penetrating its unexplored ground. Work is proceeding at St. Helens with continuous carbonization in vertical retorts; the system developed there embodying the principles laid down by the late Mr. William Young and Mr. Samuel Glover. Now, at Norwich, Mr. Thomas Glover is proposing to adhere to the horizontal form of structure, not by any means from antipathy to the vertical retort, but because modern development in retort-house appliances—in projectors for charging and in rams for discharging—has made it possible, so far as these operations go, to deal with heavier retort charges; thus allowing the construction of chambers of new and larger section than the ordinary retort. Naturally, the patent specification does not give all the information that one desires to have when a new proposal of this kind is brought forward; but, as a bed on the new system has been constructed at Norwich, in due season, when Mr. Glover has made improvement in his plans that experience discloses as of worth, full details will be forthcoming, and such results as he has achieved will be published. Until then we can afford to suspend judgment.

Shortly stated, Mr. Glover proposes to construct his large retorts of substantially rectangular cross section; the dimensions being 3 feet deep, 13 inches wide tapering to 12 inches, and 21 feet long; and the drawings show six of these retorts in an ordinary arch, though the number can, of course, be varied at will. Details of the construction of the settings need not be noticed here. The retorts it is intended to

charge with 1 ton of coal at a time; so that, if there are six retorts in a bed, the carbonizing capacity will be 6 tons. Looking at the drawings and at this figure, the first thing that suggests itself is that the plan should, if successful, give a greater carbonizing capacity per given area, and that the relation of capital expenditure to carbonizing capacity should be brought still closer. Another consideration is that the carbonizing costs, dealing with such large charges, should be reduced; though with the bulk of coke from 1 ton charges of coal being expelled at once by ram, special arrangements—perhaps rather more expensive ones than ordinarily—will have to be made for dealing with them. Another consideration is that the 3 feet depth of retort will give coke of greater density and of improved quality. A further advantage of the system is that it will retain the unit settings of gas-works, and their conveniences in heating up and letting down according to the seasonal demands of the year—a facility that would, of course, be lost to the majority of gas-works by adoption of the 17½ ton Munich chamber-settings or the bye-product coke-ovens.

These are the advantages. But it is rarely that advantages are gained without being discounted, in some degree, by disadvantages. It is almost generally agreed by those who have been using heavier charges of late in horizontal and inclined retorts that improvement in result, unexpected in the days of the orthodox lighter charge, has accrued by the reduction of the high-temperature free space and retort surface to which the evolved gases are exposed. But between the 8 or 9 cwt. charge of the horizontal retort (leaving out of consideration vertical retort working) and the work with the heavy charges of the inclined chambers at Munich and those of bye-product coke-ovens, there is little experience. Plans were months since prepared at one works for a trial of a setting of 3 feet deep inclined retorts; but it has not commenced. At Mariendorf, Mr. Körting has been trying a setting of vertical retorts of greater girth than the retorts he is now ordinarily employing, and therefore accommodating greater charges. Results, however, have not as yet been very encouraging. Mr. Glover speaks, in his specification, of the depreciating action of the exposure of the hydrocarbons of the gas to the highly heated space and the large surface-contact provided in ordinary horizontal retorts; and therefore it may be taken that, in the departure he is effecting in shape and size of retorts, he is making the further one of almost filling the retorts to the top. There is nothing said in the patent specification as to the proposed duration of carbonization. But the 1-ton charge points to the necessary prolongation of duration, and suggests whether there will be discovered a greater variation, over the longer period, in qualitative result—both illuminating power and calorific power—than under the old system of working. Of course, there is nothing comparable in what Mr. Glover contemplates with coke-oven practice and the Munich chamber working; but should it prove that the larger weights in the new shaped and sized horizontal retorts do give an unwelcome qualitative inequality in the gas products, if it should prove that there are similar drawbacks to the use of heavier weights than at present in intermittently charged vertical retorts, it may be that, for gas-making purposes with uniform quality, heavier charges will be permissible in vertical retorts when dealt with on the continuous system. There must, however, be no prejudgment; but we shall await with sharpened interest, now that the patent specification has been published, the results of the trials of the President of the Institution with his 3 feet deep retorts.

Why Not Coal Gas?

Of late years, the meetings of the British Association have not produced much that intimately concerns the gas industry; and this year the Dublin meeting (to be opened to-morrow) will not prove much better. But it will not keep so rigidly to recent reputation in this connection; and, with some amount of confidence, eyes may be turned to the Engineering Section for interesting production, the academic part of which promises well to be counterbalanced by the practical. Mr. Dugald Clerk, F.R.S., will be the President of the section; and no contemporary is in a better position, or more qualified than he, to treat broadly of the laws of thermodynamics as applied to heat engines. From a forecast of the proceedings that has appeared in "The Times," it is gathered that Mr. Dugald Clerk will particularly follow the work of that genius, Lord Kelvin, from his meeting with Joule in 1847 to his acceptance of the dynamical theory of heat in 1850-51. To impart understanding as to what Lord Kelvin did for the theory of heat engines, it is intimated that Mr. Clerk intends to discuss the opinions of some of the leading engineers of Britain as expressed at a meeting of the Institution of Civil Engineers in 1853, and compare the state of knowledge on the scientific side of heat engines at that date with the knowledge of to-day. The Committee on "Gaseous Explosions" will present their report; and it will be discussed at a joint meeting with the Physical and Chemical Sections. Mr. P. Emerson Dowson has not been heard lately at length on the subject of "Producer Gas." It is known that the earlier theories that possessed him in connection with the subject with which his name is so honourably identified have undergone decided revision through the experience of later years; and his paper should therefore be instructive on some of the modern phases of the question to be treated upon. "The Suction "Gas-Producer" will serve as the subject of a paper by Mr. P. W. Robson; and Captain H. R. Sankey will further elucidate his views on "The Utilization of Peat for Making "Gas or Charcoal." Something is known regarding Captain Sankey's opinion that there is money to be made by utilizing peat in the manner proposed. He gave expression to this during the consideration by the Parliamentary Committees of the Bill (now an Act) which frames a scheme for utilizing peat for gas making, and the gas for the prime mover in the generation of electricity for distribution in a fairly considerable area of Ireland. The meeting of the British Association being in Dublin, the subject is clearly an apposite one for discussion. Thus we see the practical application of producer gas, suction gas, and peat gas are to be dealt with at the meeting. Where is coal gas, with all its new features and expansions?

Municipal Trading on Loan Capital.

One of the great drawbacks that municipal electricity undertakings suffer is that they are established, sustained, and extended entirely on loan capital. It is considered right they should be; but the effect, under certain conditions, is that undertakings so run, having to provide a sinking fund as well as interest on capital, are in many places crippled in their essays to make a financial success of the trading. All the subtleties that man can devise under the circumstances are brought to bear upon the position; but unless the undertaking is a very favoured one, the practices that are resorted to only intensify their mischief-making character, and create a still more ignoble condition of affairs. If capital could be subscribed by investors in the ordinary way to a municipal trading undertaking, the concern be made to stand alone, and the investors take the risks of ordinary shareholders, we should have the best regulating condition that could possibly be applied to municipal trading.

The people of Dublin suffered long under the financial yoke of the electricity undertaking. There was a heavy capital expenditure for the business done; and the burdens of capital dragged at the necks of those who sought to make headway towards better conditions. There were rays of brighter light for a time; but, again, the heaviness, and increasing heaviness, of the burden is being felt. The visions of the electricity undertaking being a profit-yielding concern under municipal management, have faded away; and the ratepayers are now tired of scanning the horizon for the signs of something coming of more material form. What they do find are still advancing requests for money for feeding the concern; and these requests are accompanied by the prospect of more applications to the ratepayers for the wherewithal with which to discharge the financial obligations of the undertaking. Anticipations and realizations are vastly different matters. But there is the position; and at the meeting of the Corporation only the other day, an Alderman, who was a strong supporter of the electricity scheme when the Corporation were advised that there was money in it—true, there is, in another sense, money in it now—but who now regrets the day he was bamboozled by specious speech and report into voting in favour of the scheme, said: "I would never have supported the electric light scheme "if I had known it was going to run into half-a-million of "money as appears likely." The same thing is felt, if not expressed, by many a municipal representative to-day. Three years ago there was an inquiry in Dublin into an application for a fresh loan; and it was then estimated that £127,000 over and above the money that had been spent on the undertaking would be required to increase the generating capacity

of the concern. It is now computed that £70,000 will have to be expended upon further extensions. The increase of business, and the increased capital spendings, do not put the concern into a healthier financial state. The majority of the members of the Corporation, however, are blind to the facts. A large proportion of the additional capital has been spent in surrounding townships, and in the interior the cream of the possible custom has been obtained. The natural consequence in Dublin is that the farther the mismanagers of the electricity undertaking go, the less, proportionately, the earning power of the capital outlay becomes.

There is, some think, one remedy; and, if practicable, it would be a most effectual one. Alderman Farrell gave the prescription shape, on behalf of those who agree with him, at the meeting of the Council. It is shortly the extinction of the Dublin Gas Company. Happy thought! "The electrical "undertaking," quoth this sage, cannot make a profit for "the citizens unless virtually the Gas Company are wiped "out." The Company, however, will take a lot of killing. For years the Corporation have, by many acts (not the least of which has been the rate-aided supply of electricity), been doing all they possibly can to bring the gas undertaking to a state of exhaustion. The task has been beyond them. The Gas Company are too hardened and plethoric, and refuse to succumb to the oppression. The future will exhibit the Company in no new form or light. It is, however, one of the principal objections to the policy of trading on modern municipal principles, that such undertakings as that of electricity supply can only be run—backed by the rates and the superior power conferred upon the local governing body—in competition with a privately owned concern, by wresting from it part of its business, by attempting to depreciate the value of its property and its fulness as a rate-contributing concern, and essaying the destruction of the interests of those—many of them ratepayers—who have invested capital in it. The system is wrong; and it is strung together in dangerous manner by economic heresy. But it is established among us; and we have to philosophically make the best of it, and bear such fruits as have been plucked at Dublin and in many other cities and towns throughout the United Kingdom.

Bibliographical Review of Gas Articles.

We have received the third quarterly leaflet published by the Société Technique du Gaz dealing (in summary) with articles and papers of interest to gas engineers. The period covered by the present pamphlet is from Jan. 1 to April 1 of this year. The various articles are noted under eleven different heads. They are largely drawn from such sources as the "Génie Civil," the minutes of proceeding of the Société des Ingénieurs Civils, the Société d'Encouragement pour l'Industrie Nationale, and other technical societies and reports. Electrical lamps, gas-engines, and producers come in for a good share of the space. On the subject of "Tarring Roads," the conclusions of M. Caufourier, an Engineer of the Ponts et Chaussées, are given: Superficial tarring is only economical, he says, on hard material where there is heavy traffic, or on little frequented roads if the materials are bad; gravelled tarring is useful for heavy traffic or on average metalling if the sand is hard; metalling mixed with tar seems economical even with soft material and where there is heavy traffic. Under the heading of "Hygiene," the results of the investigations by Drs. Schanz and Stockhausen on the precautions to be taken to protect the eyesight from artificial illumination are quoted. Briefly they are: (1) All sources of light ought to have their brilliancy weakened by means of diffusive globes, so that no part of an illuminating surface of more than 0·75 hefner candle per square centimetre could be seen by the eye; (2) the lamp glasses or globes ought to absorb the ultra-violet rays, and they ought to be thick enough to form a closed surface round the source of light so as to give a dimmed uniform light; (3) indirect lighting is preferable to all other systems.

The streets of South Brent, Devonshire, were lighted with gas for the first time last week.

The death occurred last week, at the age of 56, of Professor Henri Becquerel, one of the most eminent physicists in France. His celebrity in the scientific world was mainly due to his investigations into the polarization of light, which led to his discovery of the invisible rays of uranium, and were the preface to the discovery of radium by M. and Mme. Curie.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 602.)

THE week's business on the Stock Exchange has been a surprise to many. Not only was there a remarkable degree of activity, when regard is had to the fact that it was account week at the end of August, but the tone almost throughout was bright and confident to a degree that nearly amounted to a revival. Even the sorely-tried Home Rails took a marked turn for the better, and continued to advance day by day. The American Market, a prey to battle strife in Wall Street, must be left out of notice. Consols have been up and down again. On Monday, when all the gilt-edged class were strong, they advanced $\frac{1}{16}$. The rest were steady generally, and more Gas issues (especially those secured), were quoted higher. On Tuesday the aspect of a light and easy account had a healthy influence; and the upward moves of the previous day were improved upon. Gas stocks were again noticeable in the rise. A further hardening of Consols was a gratifying feature on Wednesday; and in several other leading departments there was activity and buoyancy. Thursday was not a bad day; but before the close there were just apparent on the horizon some signs of a tendency to check the advance. On Friday a slight counter-movement set in; and some amount of realizing took place. But the markets bore it very well generally, though Consols gave way $\frac{1}{8}$. Saturday was very quiet, with several irregular movements; but the prevailing tendency was rather weaker. In the Money Market, there was a good demand for Stock Exchange and month-end requirements, but it could not stiffen rates. Discount was rather firmer. In the Gas Market, there was a fair amount of business in the first half of the week, but the last was quiet. The tendency was entirely favourable, and many quotations advanced. In Gaslight and Coke issues, the ordinary was quite firm. On Monday it was done at 97½; but it soon left this figure behind, and on Wednesday it marked 99. The secured issues were firm; the maximum changing hands at from 87½ to 88½, and the debenture at from 85¼ to 86¼. South Metropolitan was very quiet, marking from 119½ free to 120½. The debenture realized 85. Commercials were not dealt in. In the Suburban and Provincial group, Brentford new was done at 182, and West Ham at 103. The Continental Companies were rather inactive. Imperial was firm at from 181 to 182, and ditto debenture marked 94¼. Union was done 111½, and European fully-paid at 22⅞. Among the undertakings of the remoter world, Buenos Ayres realized from 11⅜ to 11½, ditto debenture 92, Monte Video 11⅞, Primitiva preference $5\frac{1}{32}$, ditto debenture, 97, River Plate $13\frac{5}{8}$ and $13\frac{9}{16}$, and San Paulo $13\frac{3}{4}$ and $13\frac{13}{16}$.

PREVARICATION AND ANTIQUITY.

The Latest Bulletin of the London Electricity Companies.

A CORRESPONDENT has sent the Franco-British Exhibition Number of the "Electrical Bulletin;" and, having read it, we sincerely hope that its wide distribution in the districts of the financiers of this advertising medium—the London Electricity Supply Companies—will induce a large number of people to inspect the electrical exhibit, otherwise the exhibit that shows how the house of Waring can furnish a bungalow for £200, *minus* the wonderful and complicated electrical cooking-table in the kitchen. If the bulletin does this, it will answer the purposes of gas well, as the visitors cannot fail to be attracted by, and to find a few minutes to spare for, the next-door neighbour, and see and test for themselves, if they are not already aware of what gas can accomplish by modern appliances, the exaggeration and prevarication that are served up to them in the "Electrical Bulletin" by, it must be assumed, the authority of the London Electricity Supply Companies, in the prosecution of their endeavours to compete with the London Gas Companies.

The bulletin treats London householders as though they were deficient in intelligence, void of judgment, and endowed with a very inferior power of observation. Of course, in the bulletin gas is spoken of as though in the waning hour of its long existence, and presently sinking into absolute obscurity. There are inane remarks about "a careful search" in the exhibition revealing "examples" of the uses of gas, and about no exhibition being complete without its museum—the antique always having an interest of its own. No doubt this is considered very smart and very funny by the person responsible for the editorial notes of the bulletin; but what think others of it all? However, even the editor of an advertising medium—though we know this is touching a common failing of advertisement writers—should really stick to facts. For instance, incandescent gas lighting might be given its rightful position of being the youngest member in the family of illuminants. Though it is the youngest, it has a striking record at its back, which incites a perpetual vilification by pen and tongue from the electrician. The editor of the bulletin, too, has been somewhat remiss in pursuing his duties at the exhibition—his admission that he has only found "examples" of the *soi-disant* old-fashioned light proves it. He has not made a thorough examination of the gas exhibit; he has overlooked the matter of some 230 high-pressure gas-lamps in the grounds, each giving a light of 1500 candles, or a total of some 345,000 candles;

and only consuming 25 cubic feet of gas each per hour, thus giving an efficiency of 60 candles per cubic foot of gas consumed; he has omitted to tell his readers of the many hundred horse power supplied by coal gas for the purposes of the exhibitors, of the gas-engines in use for the generation of electricity, and at a much cheaper rate than that at which exhibitors can purchase it, and of the enormous extent to which gas is used for cooking for the multitudes visiting the exhibition. These are all extensive practical uses of gas that are ignored by the editor of the "Electrical Bulletin," who thinks to screen them by paltry sarcasm, and a reference to the use of an electrical fan at the stand of the Gas Section Committee. What the Electrical Companies would have done without the fans in their bungalow in the Machinery Hall some days this summer, we do not know. The stuffy rooms would have been very uncomfortable for visitors.

This brings us to yet another example of the prevarication of the editor of the bulletin. We take it as rather a compliment than otherwise that the editor should give so much attention to the "JOURNAL." To incite such perpetual resentment is an eloquent and cogent tribute. But the editor shows a poverty of wit in raking up his now stale joke, describing the "JOURNAL" as the old flat-flame champion. Of course, it is the "old" flat-flame champion—the champion of flat flames in the pre-incandescent gas-lighting days, just as it has been the champion of the incandescent gas mantle since it attained the practical success of the early nineties. But to a further instance of prevarication. The bulletin connects up directly and solely with the gas exhibit a reference by us to a complaint that was prevalent among the attendants in the Machinery Hall of the heat of the place during the hot weather.

Turning to another part of this issue of the bulletin, there is found an article entitled "Light: A Few Words on the Advantages of Electricity as an Illuminant." It is much the same kind of thing that has been read time and again—much in it that is wild and loose. There are the usual well-weathered statements as to products of combustion which engender carbonic gas, soot, and many other malignant evils that have, with exceeding great diligence, been attributed to gas, but do not appear to be traceable by the electricians in the mortality statistics. In this article too, we see the editor has exhumed some data published by the long-since deceased Dr. Meymott Tidy. It is enough to make that eminent scientist turn in his grave to have these figures of an age long ago applied to gas under modern circumstances. The London Electricity Companies, who finance this periodical, wink their eyes at so gross an abuse of honest business competition. Any weapon appears good enough for them. Business in domestic lighting must be with them very difficult to get when they connive at this sort of thing—using names and data without any consideration for time and changed conditions. It will be remembered by our readers who have arrived at a fairly ripe age that Dr. Meymott Tidy's tests were made in days before the refinement in gas manufacture and illumination such as we have at present had been reached. Dr. Tidy instituted certain tests in order to show the quantity of oxygen consumed, carbonic acid produced, &c., by burning in an hour gas, paraffin oil, and tallow candles sufficient to yield a light of 12 standard candles. Gas showed the best result of all from the consumers' point of view. But these tests were made with flat-flame gas-burners, consuming at least 5 cubic feet of gas to realize a light of 12 candles. Now, by the modern forms of incandescent gas-burners for domestic purposes, an illumination can be obtained equal to 12 candles for every ½ cubic foot of gas consumed. What justification, then, is there for using under present changed circumstances figures that are hoary with age? The use of the figures shows a depth of meanness the defence of which we shall be glad to see, if defence there can be. It is full time the electricians stopped digging so deep into the past, and offer facts and not mere expressions of opinion referring to the present. These expressions of opinion are just as valuable as are the advertisement postulation that electricity is the cheapest illuminant light for light; the electricians keeping, after the assertion, a safe distance from practical proof on a comparable basis.

The bulletin gives a couple of pictures showing the lighting of the façade of "The Swallow" in Swallow Street, Piccadilly, first by incandescent gas-lamps and then by electricity. The pictures are a splendid advertisement for gas. Their circulation will not prove of any advantage for electric lighting. The editor on this deserves our thanks. Besides this, there are several points in this number of the bulletin that invite criticism, and which are opposed to the experience of gas consumers; and there are also several points that will assist in persuading even lay readers that electricity is not all it is represented to be.

"Book-Keeping Down to Date."—In previous editions of the "JOURNAL," we have directed attention to a useful little work, bearing the above title, by Mr. Andrew Munro, F.C.S.I. The intermediate and advanced edition of it having attained considerable popularity as a practical manual for the class-room and the counting-house, has induced the author to produce a work suitable for beginners, a copy of which we have received. Without overloading the text, the author has given a full explanation of the elementary principles of modern book-keeping, and illustrated them by a number of graded exercises. The publishers of the book are Mr. Effingham Wilson, 54, Threadneedle Street, E.C., and Messrs. W. & R. Holmes, 3, Dunlop Street, Glasgow. The price is 1s. net.

PERSONAL.

The employees at the Burslem Gas-Works assembled a few evenings since to make a presentation to Mr. EDWIN BASKEYFIELD, the Works Foreman, who has just retired after 32 years' service. Mr. Edward Jones, the Engineer, presided. The gift consisted of a large photograph portrait, with an engraved inscription plate, in a handsome gilt frame. The presentation was made by Mr. John Kelly, who has been employed at the works for upwards of fifty years. He spoke of the sorrow he felt at Mr. Baskeyfield's departure, as they had worked together for so long. On behalf of the officials and workmen, he asked him to accept the present as a token of their respect and esteem. Messrs. Tyson, Walker, and Walton testified to the many good qualities of Mr. Baskeyfield, with whom they had worked harmoniously. The Chairman referred to Mr. Baskeyfield's excellence as a carbonizer, and to his thorough knowledge of gas-works practice, and said he sincerely hoped he would be blessed with good health for many years to enjoy his well-earned retirement. Mr. Baskeyfield expressed his thanks for the present, and for the generous and friendly sentiments accompanying it. He said he deeply appreciated their kindness and prized their gift, which could not fail to call up many happy memories. The meeting ended with musical honours.

OBITUARY.

HENRY GREEN.

IT is with extreme regret that we record the death, early on Sunday morning, of Mr. Henry Green, the Engineer and Secretary of the Preston Gas Company. Many of our readers are aware that Mr. Green had been in ill-health for some time; and it was mentioned in the "JOURNAL" last week that at the recent half-yearly meeting of the Company a resolution was passed expressing the shareholders' sympathy with him. Almost simultaneously with the reception of this resolution came the sad news of the death of his son Herbert. Mr. Green's health was impaired by an accident he met with last autumn when in Scotland; and for the whole of the present year he was below par. Acting on medical advice, he went away during May and June to recuperate. Unfortunately, he continued to lose ground, and about six weeks ago was ordered home from Arnside, where he was staying. The doctors then diagnosed the trouble as an internal growth. Later symptoms indicated an aneurism; and this was confirmed by a specialist. After being confined to his bed, the growth developed rapidly; and for the last two weeks before his death he was continuously under the influence of morphia. He was conscious of his son's death; but the latter's condition was such that his father really felt his release as a relief.

Mr. Green was born at Bolton in 1834, and was the third son of Mr. James Green, the Engineer of the Bolton Gas Company, under whom he received his early training in gas engineering, and with whom he was subsequently associated as assistant. In January, 1861, he was appointed Engineer and Manager of the Preston Gas Company, and two years later received the additional position of Secretary. Preston was the first of the provincial towns to be lighted with gas; and in 1861 the works ranked third in importance in Lancashire; the annual output of gas then being 134 million cubic feet, and the net price to ordinary consumers 4s. 4d. per 1000 cubic feet. During Mr. Green's long term of office, the business of the Company steadily developed and expanded; and the annual output is now some 513 million cubic feet, or practically four times that of 1861, and the net price has been reduced from 4s. 4d. to 2s. 11d. per 1000 cubic feet—a reduction of 33 per cent., while no less than 1½ million tons of coal have passed through the works for conversion into gas.

To meet this continued growth of business, Mr. Green had to remodel and rebuild the whole of the works at Glover Street, Moor Lane, and Walker Street, and to establish a storage station at Ribbleton Lane, where the gasholders are situated. In the laying out of these works, and in the design of the necessary plant, Mr. Green displayed an originality and ability which secured for him a foremost place among the gas engineers of the country; and the improvements he effected in the construction of purifiers have led to the adoption of the well-known "Green" type in most modern works. His inventive faculties also found expression in the design of plant for the manufacture of sulphate of ammonia, which recently received the high encomiums of the Chief Inspector under the Alkali Act, and in many minor appliances for the manufacture and distribution of gas. These include a distributor for scrubbers, canvas screens for filling scrubbers, a leak indicator for luteless purifiers, a prepayment and an underground meter, an automatic device for lighting lamps, and safety gates for hoists; and they have been referred to from time to time in our columns. He was also one of the first engineers to apply mechanical means for stoking.

Mr. Green was elected an associate member of the Institution of Civil Engineers in 1879. He had joined the British Association of Gas Managers ten years previously, and passed into the Incorporated Gas Institute, at the meeting of which body in Belfast in 1898 he contributed a paper on "The Construction of, and Mode of Working, Purifiers." He passed in due course into the present Institution, and was a member at his death.

All his work was characterized by energy, by determination,

and by much shrewd common sense; while in private life his high character, strong appreciation of justice, and charitable disposition won the regard of those who were privileged to know him. Though not taking a prominent part in public affairs in Preston, he was appointed a Justice of the Peace for the borough in 1897, and participated actively in the work of the Licensing Committee, of which he was a valued member. He was also a Trustee of the Harris Orphanage, an ex-Vice-President of the Conservative Association, and a P.M. of the Unanimity Lodge of Freemasons. He leaves three daughters and one son. The funeral will take place to-morrow at the Preston Cemetery.

We regret to record the recent death, in his 84th year, of Mr. EDWARD RICHARD LOVEGROVE, of Maidenhead. Deceased was elected a Director of the Maidenhead Gas Company in 1855, became Vice-Chairman in 1874, and Chairman in 1886. This position he held till his death severed a connection with the Company extending over 53 years. The late Mr. Lovegrove was a Justice of the Peace for the borough of Maidenhead, and the representative of a family long and prominently connected with the town and trade.

AMERICAN RULES AND REGULATIONS AS TO GAS SUPPLY.

IN the book, on "American Practice of Gas Piping and Gas Lighting in Buildings," which was recently reviewed in the "JOURNAL" (see *ante*, p. 227), the author—Mr. W. P. Gerhard—devoted a short chapter to a specification covering the gas-piping required for ordinary buildings, and suitable for coal or water gas. This was followed by a further chapter giving examples of the rules and regulations adopted by some of the more important cities in the United States; and they indicated, as remarked by Mr. Gerhard, the present American practice of piping buildings for gas. The specifications thus quoted are those of the Consolidated Gas Company of New York, the Bureau of Buildings for the Borough of Manhattan, the United Gas Improvement Company of Philadelphia, the Building Commissioners of Boston, the District of Columbia, the Hudson County Gaslight Company of Hoboken (N.J.), the Milwaukee Building Department, the Denver Consolidated Gas Company, the Cincinnati Gaslight and Coke Company, and the People's Gas Company of Chicago.

The rules of each district are separately dealt with, and they occupy some few pages of the volume referred to. It will be obvious that many of the regulations are identical in substance, if not in phrase. While, therefore, we purpose taking the liberty of reprinting the specifications thus issued by the various American undertakings, we shall do so by extracting from them all in the form of one specification, in order to avoid repetition. Where any particular clause is given by one specification only, the name of the Company will be added; but regulations not so marked may be taken to be general to most of the undertakings named, and therefore to represent American gas-piping practice.

GENERAL SPECIFICATION.

Before the construction or alteration of any gas piping in any building or part of any building, a permit must be obtained from the Superintendent of Buildings. This permit will be issued only to a registered plumber. Application must be made and complete floor plans filed, showing each and every outlet and the number of burners to go on each outlet before beginning work. Small alterations may be made by notifying the Bureau of Buildings, using the same blank forms provided for alterations and repairs to plumbing. [Manhattan.]

On the application of the owners of property situated on the avenues and streets through which the [ ] Gaslight Company have their gas-mains, a service-pipe of sufficient size to furnish all the gas that may be required will be placed, free of cost, from the said gas-main in the avenue or street, to a distance not exceeding 25 feet from the kerb line thereof. Should more than the said 25 feet from the kerb line be necessary, then the owner will be charged, for each additional foot, the actual cost of pipe and labour. [Hudson.]

In piping new houses the gas company is to decide where the gas-meter should be located, and the fitter shall extend the riser to terminate within 2 feet of this point. The location of meters shall not be under stoops or sidewalks, near furnaces or ovens, or such as to render the meter inaccessible or liable to injury.

When, to accommodate different tenants, one or more meters are desired in a given building, the company will set as many meters as there are separate consumers, connecting the meters to one service-pipe, provided that the risers or pipes leading to these different tenants are extended to within 2 feet of the location of the meters. As far as possible, meters should stand side by side in the cellar or basement, and fitters should obtain from the gas company the proper size of the meter to set, and also the spacing for outlets in header.

Risers should not be scattered, but should drop together in alignment to the cellar or basement. They should not extend more than 3 inches below the ceiling, and they should be kept at least 3 inches apart. No elbow should be put on the bottom of any riser or rising service, but the bottom of all risers should have a T.

Where it is not impracticable so to do, all risers shall be left not more than 5 feet from the front wall. [Manhattan.]

All meters located in cellars must be at least 4 feet above the cellar floor. [Columbia.]

The service-pipe shall be run, and both connections with the meter shall be made, by the gas company.

There shall be a heavy brass straightway cock or valve on the service-pipe immediately inside the front foundation wall. [The Boston rules require two valves—one on the inlet the other on the outlet of the meter.] Iron cocks or valves are not permitted.

The size of pipes shall not be less than those called for in the following table:—

Size of Pipe. In.	Greatest Length Allowed. Feet.	Greatest Number of Burners.	Size of Pipe. In.	Greatest Length Allowed. Feet.	Greatest Number of Burners.
⅜	20	3	1½	150	100
½	25	6	2	200	200
¾	40	20	2½	300	300
1	60	30	3	450	400
1¼	100	60	4	600	700

The foregoing table shows, for any given number of outlets, the greatest length allowed for each size of pipe.

[*Note.*—The above table is taken from the New York regulations, but is common to several other specifications. The Manhattan table, however, credits the same size pipes with a greater, and the Milwaukee table with a smaller, carrying power.]

Manhattan Scale.

Diameter. In.	Length. Feet.	Burners.	Diameter. In.	Length. Feet.	Burners.
⅜	26	3	1½	150	100
½	36	6	2	200	200
¾	60	20	2½	300	300
1	80	35	3	450	450
1¼	110	60	4	600	750

The following rules should also be observed: No house riser shall be less than 0·75 inch. The house riser is considered to extend from the cellar to the ceiling of the first floor. Above the ceiling the pipe must be extended of the same size as the riser, until the first branch line is taken off. No house-pipe shall be less than 0·375 inch. An extension to the existing piping may be made of 0·25-inch pipe to supply not more than one outlet, provided the pipe is not over 6 feet long.

No branching for a range shall be smaller than 0·5 inch. [*Note.* Philadelphia stipulates for 1 inch.]

Gas is never to be supplied from a smaller pipe to a larger one. No pipe smaller than 0·5 inch shall be used between the outlet of the meter and the outlet of the range pipe. Of any given size pipe, do not run a longer length than the longest length given in the table for that size. In figuring out the size of pipe, always start at the outlets, or extremities of the system, and work towards the meter.

The running of gas-pipes on the inside of outside walls is to be avoided as much as possible. Owing to the exposed location, they are easily stopped by frost, and are often a source of annoyance during cold weather. [New York.]

All gas-piping shall be of the best quality wrought iron, and of the kind and weight classed as standard pipe. Fittings (except stopcocks or valves) shall be of malleable iron. [Manhattan.]

The use of galvanized pipe for gas is to be avoided, on account of the chemical action between the condensation in the gas and the covering on the pipe, which has a tendency eventually to result in the obstruction of the pipe. Galvanized iron fittings are not so objectionable, as the galvanizing tends to close the pores which are frequent in malleable or cast-iron fittings. [New York.]

The piping must be free from obstructions. Every piece of pipe should be stood on end and thoroughly hammered and blown through before being connected. Use white lead or other jointing material sparingly, to avoid clogging the pipe. Always put jointing material on the male thread on the end of the pipe, and *not in the fitting*. The use of gas-fitters' cement is prohibited. All piping should be blown through after being connected, to make sure it is clear. The piping must be free from traps. All pipes shall grade-back towards the riser, and thence to the meter. Use a spirit-level in grading. Any pipe laid in a cold or damp place should be properly dripped and protected. The pipes must be rigidly supported by hooks and straps. Outlets for brackets or drops must be secured by straps or flanges nailed or screwed to the woodwork. Where the walls are of masonry, they should be plugged, and the straps fastened to the plugs.

No pipe shall be laid so as to support any weight (except the fixtures), or be subjected to any strain whatever. Split pipes or fittings will not be accepted, even though skilfully cemented.

Always use fittings in making turns; do not bend the pipe. Do not use unions in concealed work. Use long screws, or right-and-left couplings. Long runs of approximately horizontal pipe must be firmly supported at short intervals, to prevent sagging. All branch outlet-pipes must be taken from the sides or tops of running lines, never from below. Bracket lines must be run up from below; never drop them from overhead, except in the lowest floor or cellar of buildings. Where pipes pass through masonry walls, they must be encased; the gas-pipe resting on the bottom of the casing pipe, with a clearance of half-an-inch at the top. Pipes must be run and covered so as to be readily accessible. Do not run them at the bottom of floor beams, which are to be lathed

and plastered. They must be securely attached to the top of the beams, which should be cut out as little as possible. Where pipes are parallel to beams, they must be supported by strips nailed between two beams. These strips must not be over 4 feet apart. All cutting of beams should be done as near as possible to the ends or supports of the beams. Pipes must not be laid beneath tiled or parquet floors, under marble platforms, or under hearthstones, where it can be avoided. Floor-boards or pipes should be fastened down by screws, so that they can readily be removed.

All outlets and risers shall be left capped or covered with fixtures.

Service-pipes in cold or damp places shall be painted with two coats of red lead and boiled oil.

All gas-brackets and fixtures shall be placed so that the burners are not less than 3 feet below any ceiling or woodwork, unless the same is properly protected by a shield, in which case the distance shall not be less than 18 inches. No swinging or folding gas-brackets shall be placed against any stud, partition, or woodwork. No gas bracket on any lath and plaster partition or woodwork shall be less than 5 inches in length, measured from the burner to the plaster surface or woodwork. Gaslights placed near window curtains or any other combustible material shall be protected by a proper shield. Gas outlets for burners shall not be placed under tanks, at the backs of doors, or within 4 feet of any meter.

Outlets for gas-ranges shall have a diameter not less than required for six burners, and all gas-ranges and heaters shall have a straightway cock on the service-pipe. When brass piping is used on the outside of plastering or woodwork, it shall be classed as fixtures. All brass tubing used for arms and stems of fixtures shall be at least No. 18 standard gauge and full size outside, so as to cut a full thread. All threads on brass pipe shall screw in at least $\frac{5}{16}$ inch. All rope or square tubing shall be either brazed or soldered into fittings and distributors, or have a nipple brazed into the tubing. All cast fittings, such as cocks, swing joints, double centres, nozzles, &c., shall be extra heavy brass. The plugs of all cocks must be ground to a smooth and true surface for their entire length, be free from sandholes, have not less than 0·75 inch bearing (except in cases of special design), have two flat sides on the end for the washer, and have two nuts instead of a tail-screw. All stop-pins to keys or cocks shall be screwed into place.

In piping residences, a 0·5-inch line, or preferably a 0·75-inch line, should be run from a point near the meter to the kitchen, to provide for a gas-range. This line should terminate about 15 inches from the floor, when protruding from a wall.

In piping for prepayment meters in buildings having four families on a floor, the following plans should be carried out: The pipe from the service to the bottom of the front riser should be 1·25 inches; from the bottom of the front riser to the bottom of the rising services it should be 1 inch, to within two floors of the roof, where 0·75 inch may be substituted. All openings to be left shall be at least 0·5 inch. Prepayment meters will not be set in bedrooms; and all prepayment meters must be set within the apartment. Before piping a building for prepayment meters, fitters should consult the gas company, so as to avoid mistakes.

In all cases of repair of leaks, a notice giving the location and extent of all work performed shall be filed with the Building Commissioner immediately upon completion of the same. No pipe or fitting shall be covered or concealed from view until approved by one of the gas inspectors of the Building Department, or for 24 hours after notice has been given to the Building Commissioner. [Boston.]

The piping must be tight under a pressure of 10 inches of a mercury column. This test will be made before the fixtures are hung, and after the piping is closed in. [New York.]

[*Note.*—Manhattan applies a mercury test of 6 inches for five minutes; Philadelphia, 6 inches for ten minutes; Boston, with both piping and fixtures, 2 inches for five minutes; Columbia, 6 inches; Cincinnati Gas Company, 30 inches; Milwaukee, 20 inches; and Chicago, 6 inches.]

When the fitter has completed the system of piping, made the test, and found the pipes tight, he should promptly notify the company. An appointment will be made, and the company's inspector will call and witness the test. If the pipes are found tight, the following certificate will be issued:—

——— *Gas Company.*

This is to certify that the [ ] Gas Company has inspected the piping at No. ——, ——— Street, and has found it to be gas-tight.

As any injury may occur to the piping subsequent to this inspection, its future soundness is not guaranteed.

Date———— By———*Inspector.*

During the inspection, the fitter or his representative must be present.

SPECIFICATION CLAUSES FOR FUEL-GAS PIPES.

The Milwaukee Building Department, the Denver, and the Chicago Gas Companies include clauses dealing specifically with fuel-gas piping. These are mainly as follows:—

All piping for a separate fuel system must be taken from a branch from the service-pipe, a separate meter provided, and must be run and used for supplying gas for fuel only. No illuminating flames will be allowed, and no branches or outlets provided for other openings than those connected with fuel appliances. A fuel meter will not be furnished under any circumstances until the gas appliance is in place and connected. Fuel meters will not be connected to a pipe leading from the outlet to another meter. Fuel rate will not be allowed for any appliance attached to pipes supplying gas for illuminating purposes. Should illuminating burners be found on any pipe supplying gas at the fuel rate, the company reserves the right to remove the fuel-meter upon 48 hours' notice, and to charge the full illuminating rate for all gas furnished to such consumer from such time as the fuel meter was set.

To govern the size of tubing to be used in piping for fuel systems, the following rules should be followed: (*a*) Consider that each piece of apparatus will be used to its maximum, and all pieces at one and the same time. (*b*) Use as a basis for figuring pipe that a four-hole range uses 50 cubic feet per hour, and a six-hole range 80 cubic feet. Each gas-fire or log uses 50 cubic feet per hour, and each water-heater 25 cubic feet. If in connection with a range, add 25 cubic feet to the consumption of the range. Smaller appliances, 25 cubic feet per hour. (*c*) Figure each length of pipe between openings separately, commencing at the meter. (*d*) Do not run over 20 feet of 0·5 inch, 50 feet of 0·75 inch, 80 feet of 1-inch, 100 feet of 1·25 inch, 150 feet of 1·5 inch, and 200 feet of 2 inch. Openings for fuel appliances should, as a rule, be 12 inches from the floor, and project 1·5 inches clear from the finished wall. All other rules for piping and inspecting not inconsistent with these will be the same as for illuminating gas.

Rusting of Iron Water-Mains.

A quantity of water which is rich in iron is now being used for town supplies in Germany, and in these cases the process of preliminary aëration is resorted to, in order to remove the bulk of the dissolved iron salts. It is maintained by Herr Oesten, of Berlin, that such water is liable to reabsorb iron from the mains; and the subject has been vigorously debated. According to the "Engineering Supplement" to "The Times," Dr. Noll supposes that the reaction which takes place may be explained by the following equation: As soon as the protective coating on the surface of the iron is worn away and the metal is exposed, we have $Fe + CO_2 + H_2O = Fe\,CO_3 + H_2$; and if free oxygen is present in the water, separation of iron hydroxide takes place, causing a deposit in the mains. In this case the carbonic acid is liberated, and further iron is dissolved, or the mono-carbonate of iron may be converted into bicarbonate. If the water contains an abundance of oxygen and but little carbonic acid gas, a recombination of carbonate of iron with the water cannot occur; but the amount of hydroxide of iron formed in the mains is larger. If but little oxygen and abundant carbonic acid are present, a large amount of bicarbonate of iron will be formed. It is pointed out that at the Hamburg Water-Works, since the substitution of filtered Elbe water for the untreated river water, both the cast and wrought iron mains have been strongly attacked; and Dr. Noll suggests that when river water was in use the organic matters present tended to form a protective slimy coating on the pipes, which prevented the aggressive action of the carbonic acid. The theory of the reaction put forward by Dr. Noll is stated, however, by Herr Oesten to be inapplicable in the case of the Berlin mains.

Blowing up a Gasholder-Tank.

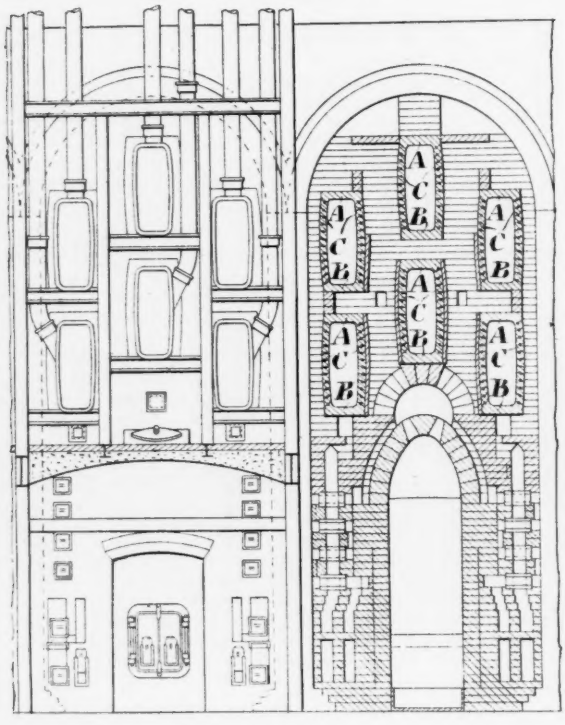
The last number to hand of the "Journal für Gasbeleuchtung" contains an account by Herr von Feld, of Brunswick, of the destruction by blasting of a concrete gasholder tank at Wolfenbüttel, which had to be disposed of in order to clear the site for a steel tank of larger dimensions. The old gasholder was of 35,000 cubic feet capacity, and the top of the tank stood about 8 feet above the level of the ground. It was 50 feet in diameter, and the concrete walls were about 30 inches thick. There were, further, six piers, to which the old guide-columns had once been attached, which had a cross section of about 5 ft. by 5 ft. In each column there were four iron anchors about 8 feet long. The concrete was of very good quality. When a start was made at breaking it up with tools by hand labour, it was found that only about one-tenth of the whole had been dealt with in eight days' hard work by a number of men, and the piers had not been touched. It was decided, therefore, to attempt to break up the concrete with explosives; but the position of the holder rendered this a task involving great danger. At a distance of 13 feet there was an inhabited house, and at about 6 to 7 feet on the other side was a second gasholder which was in use. Application was made to a battalion of Hessian Pioneers quartered in Münden, near Hanover, as to whether the destruction of the concrete could be safely carried out by blasting. The task was entrusted to them, and was successfully carried through in about three days. Special precautions were taken for the protection of the surrounding buildings. Planks and thick layers of straw were used to form protecting walls round the spot where a shot was to be fired, so as to avoid the scattering of the dislodged particles; and in specially difficult positions iron plates, fixed to strong wooden balks, were also used. Beyond the shattering of some twenty window-panes, nothing was destroyed except the concrete which was being dealt with. The work was undertaken by the Battalion of Pioneers on account of its interest and value for training purposes.

THE THOMAS GLOVER CONSTRUCTION OF RETORT-OVENS.

As Described in Patent Specification No. 17,875 of 1907.

The specification was issued last week of a patent applied for, on Aug. 6, 1907, by Mr. Thomas Glover, of Norwich, for "Improvements in, and Relating to, Retorts for the Production of Illuminating Gas, Coke, and Other Residuals."

In the words of the patentee, the object of the invention is to construct retorts or ovens of rectangular or other cross section similar to modern bye-product recovery coke-ovens, but of much smaller size, and built in groups or sets, within an ordinary main-arch of a retort bench as used in gas-works, and heated by means



of producer gas. It is intended by the arrangement now proposed to retain the convenience of the unit-setting as now employed in gas-works for putting on, or letting down, to meet the varying demands for gas at different seasons, to improve the density and quality of the coke by the use of retorts narrow in cross section as compared to the depth, to reduce the operating costs by putting in, by means of a projector charging machine, a charge of about 1 ton in place of about 8 cwt. of coal, and to discharge the whole of the resultant coke at one operation by means of a ram, also to avoid the decomposition of the hydrocarbons during distillation.

Hitherto, the patentee proceeds, it has been the practice to use retorts of circular, oval, or ⌂ section (chiefly the latter), constructed with main arches in settings or groups of any number up to twelve in a set. The length of the retorts varies from 9 feet for single settings to 22 feet for through or double settings. The ordinary limit in sectional measurement of the retorts of ⌂ section is 22 inches wide and 16 inches high. The weight of coal charged into a retort of this section and 20 to 21 feet long is usually 7 to 8 cwt.; and the period allowed for completing the distillation of this weight is usually six hours.

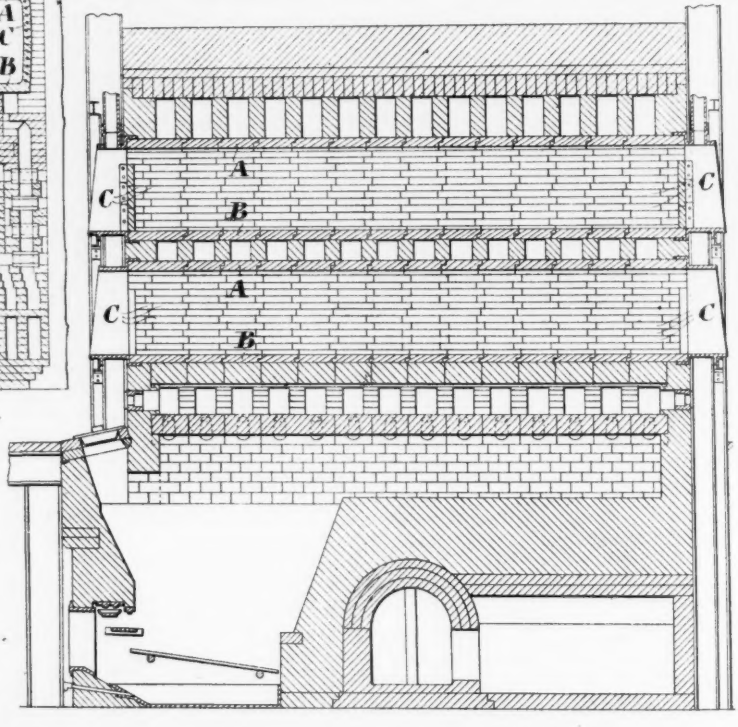
The section of retort in common use has been determined to a great extent by the appliances the gas-maker has been able to command for placing the charge of coal into the retort and for withdrawing the residual coke. For charging, the shovel or scoop (the latter sometimes worked by machinery) has been usually employed; and, for withdrawing the coke, rakes worked by hand or machinery have until recently been solely used. There are other factors which have governed the size and shape of the retorts and the number built into one main-arch; and these are briefly: First, the necessity for keeping up an even production of gas, of constant quality, during the 24 hours of each day. For this purpose, two or more retorts are usually charged in each setting at intervals of about every two hours. Second, regarding a setting as a unit, the number and size of the retorts in a setting control the capacity of the unit, and this must be adapted to the requirements of various gas-works.

By the use of such retorts only comparatively small charges can be put in at each operation—usually about 8 cwt.; and the operating costs are high as compared with coke-oven practice, where carbonization is done in bulk.

The gases as they are evolved in an ordinary gas-retort pass slowly between the upper surface of the charge and the highly-heated crown of the retort to the take-off or ascension-pipe, and are subjected to severe decomposing action, whereby the hydrocarbons are cracked and free carbon is deposited on the surface of the retorts, in the pipes and in the condensed tar. The greater the area of the free space above the charge, and the thinner the retort-walls at the crown, the more severe is the decomposing action.

The introduction of retort-charging machinery of the projector type—whereby a constant stream of coal is projected at any required velocity into a retort, and such operation can be continued until a charge of any desired weight is placed in the retort—together with the use of discharging rams similar to those now in common use for discharging coke from bye-products recovery coke-ovens, makes it possible to work retorts comparatively narrow in section as compared with their depth, but of a cubical capacity much greater than ordinary gas-retorts.

The use of such retort-ovens as those described in this invention and shown on the accompanying illustrations would, the patentee contends, result in a reduction of operating costs owing to the greater weight of coal put in, and the greater weight of resultant coke discharged, at each separate operation; while the coke made in this form of retort-oven would approximate in quality to the metallurgical coke produced in bye-product recovery coke-ovens—being dense and in large pieces. The quality



of the coke could be varied by the temperature applied to the retort-ovens and by the period of carbonization.

The illustrations show a front elevation and section of two adjacent settings each containing six retorts, and a cross section of same.

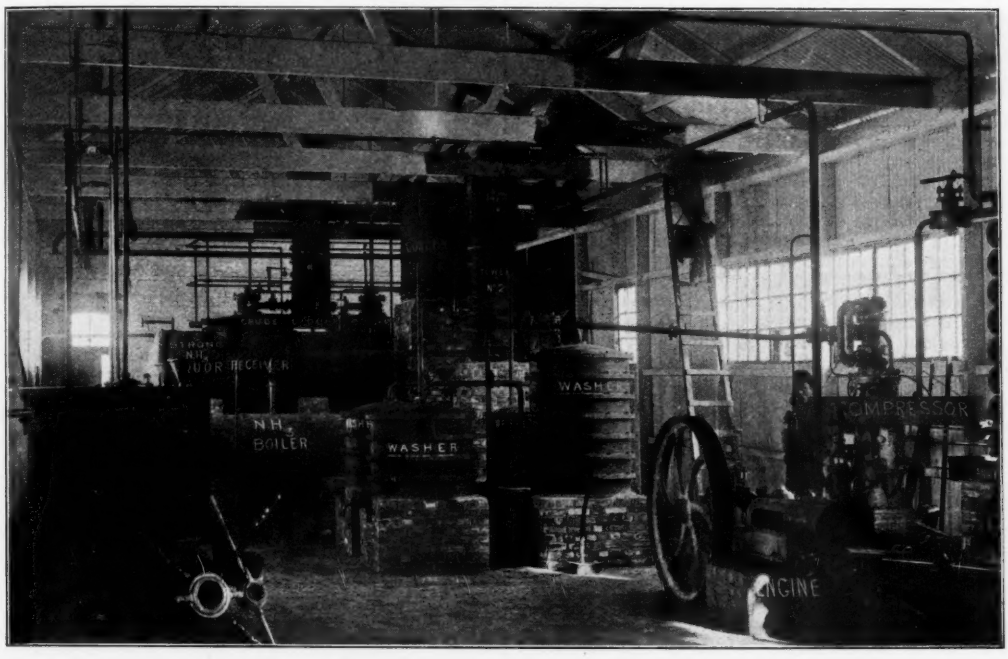
Any convenient size may be used, it is pointed out; but for the purpose of explanation the inventor assumes a setting of retorts of a size (say) 3 feet deep by 13 inches wide, tapering to 12 inches, and 21 feet long. It is necessary to construct the sides of the ovens or retorts to resist the lateral thrust of the brickwork when the latter is expanded by heating, but at the same time to keep the sides as straight as possible. To do this, the top A and the bottom B of the ovens are constructed in solid sections of convenient length, having rebated joints where the sections meet, and having skew-backs from which the key-bricks C forming the sides of the ovens are started. The key-bricks are grooved or rebated so that the fireclay cement in which they are set forms a tongue, and the bricks are shaped to allow of a slight camber when built, but which may straighten out when the sides of the ovens are under compression, due to expansion by heat of the brickwork of the setting.

The claims made for the invention are: 1. The construction and arrangement of substantially rectangular or deep retorts built in groups or sets within an ordinary main arch of a retort-bench and heated by producer gas—such retorts having outwardly curved sides. 2. The method of constructing the retorts as claimed in the first claim, whereby they are able to resist the lateral thrust of the brickwork when heated, consisting of top

and bottom sections rebated together at their respective joints, and having skew-backs between which the key-bricks forming the sides are inserted. 3. The arrangement and construction of retorts for the production of illuminating gas, coke, and other residuals substantially as described with reference to the accompanying drawings.

AMMONIA PLANT AT THE PORT ELIZABETH GAS-WORKS.

We have received from Mr. William Arnott, the Manager of the South African Lighting Association, some photographs he has lately taken in the retort-house and in the room containing the ammonia plant. It was difficult, in the absence of light in the retort-house, to get good pictures, as they had to be instantaneous; the prints sent having been produced from negatives obtained with an exposure of 1-25th of a second. They show the retorts in process of being drawn and the coke quenched; the stokers being Kaffirs, who work with bare feet and legs, and whose only garment is a coal-bag. We regret that all these photographs



are much too indistinct to permit of reproduction. Those of the ammonia plant are, however, much better; and one of them we give. The plant shown has been put in for the manufacture of anhydrous and ·880 ammonia, and also household cloudy ammonia. The production of sulphate is out of the question; acid being very expensive owing to the carriage and freight from England. The picture is of interest as showing engineers at home what a colleague 7000 miles away is doing; and it also furnishes evidence of the enterprise of the Directors of the Association and of the business capacity of their General Manager.

COKE CONVEYORS AT THE HONG KONG GAS-WORKS.

In connection with the series of articles which are being contributed to the "Journal" by Mr. Maurice Graham, descriptive of his tour round the world, our readers will doubtless be interested in the above picture, which has been reproduced from a photograph received from Mr. John M'Cubbin, the Resident Engineer of the Hong Kong and China Gas Company. While his professional brethren in the West have at their disposal either mechanical coke-conveyors or "the man with the barrow," he has to depend upon coolie labour; and the illustration shows how it is utilized in the creation of the coke heap at the gas-works.

PUBLIC LIGHTING IN LONDON & ELSEWHERE.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The drawing-in of the hours of daylight in the evenings is a reminder that the lighting season of 1908-9 is about to commence, and our ideas are naturally directed towards the subject both of public and of private lighting. This must be the excuse for offering a few remarks suggested by the report on the public lighting of the City of London by Mr. A. A. Voysey, as published in the "Journal" for June 9 (p. 640), which excited some comment at the time. Judging by the title and by the official position of the author, one would expect to find in this production an independent report dealing with the subject from a general and impartial point of view; but, on perusal, it is evident that several elements usually to be found in a Corporation lighting engineer's report are missing, and that the distinctive features throughout are in the direction of a specially constructed case in favour of a particular form of electric arc lamp. I do not propose to follow this example, by introducing points in favour of gas, but rather to deal with some general considerations as to public lighting.

In an official report, one would expect to find a distinct line of demarcation between general advantages—such as the partial reduction at midnight, a revised lighting schedule, 28-feet lamp-standards or no standards at all, which obviously are common to all or any system of lighting—and any special features peculiar to one system only. Comparisons of cost, to be of any practical value, should be made on equal bases, both with respect to illuminating power and all other circumstances, with full details of cost, and the data should consist of fair working figures, not of special rates founded upon artificial prices quoted for an experiment only. A natural price is one that pays all expenses and leaves a fair profit. But it is no uncommon thing for a company to carry out a demonstration for less than cost, or even gratis. To take this point to an extreme, because a dozen lamps are supplied free and as an advertisement, it would not be safe to assume that the whole district can be lighted for ten years on similar terms.

Electricians have always been willing to delude the public by mixing up general and special advantages. They commenced their career with statements based on a comparison of the nominal candle power of so-called 2000-candle arcs with the actual light-giving quality, as indicated by the photometer, of an antiquated and practically obsolete form of gas-burner. In the report under notice we find 600-candle gas-burners compared with arcs of much higher power. But it is evident that a fair comparison of costs can only be made between lights of approximately equal power, because the cost per candle is not in proportion to the photometrical result, but decreases rapidly as we approach large sizes. A 20-candle light of one kind should therefore be compared with a 20-candle of another, and not with a 200 or a 500 candle light. One 2000-candle centre costs less to supply and maintain than four 500-candle centres; and it is simply stealing an advantage in favour of the larger light to state the cost per candle-hour as between lights of widely varying value. Full details as to cost will enable investigators to substitute the particular figures for any individual case; but any data that come below the actual cost of production and distribution, as shown by the audited accounts of the companies concerned, may be disregarded in connection with large estimates covering a term of years. Every board of directors depends for its existence on ability to earn a dividend for the shareholders. Nor is it fair to put the lighting of one street against that of another, seeing that every thoroughfare is to a great extent a law to itself. The effective light as indicated by the photometer is influenced by the surroundings—the colour and height of the buildings, the proportion of open background, the line of street as shown on plan, &c. No one would expect to get like results on a bridge over a wide river as in a narrow street lined with light-coloured buildings.

Another fundamental error introduced by electricians thirty years ago, and adopted by Mr. Voysey, is that candle power is the same thing as money value. Given a street already sufficiently lighted, it is difficult to convince the average ratepayer that by doubling the light you halve the cost. It is equally futile to endeavour to persuade him that 1000-candle power, or any given quantity, is equally valuable, no matter how produced. The photometer tells us something, but not the whole story; and, apart from the debateable question of the limits of reliability possessed by this instrument, and the degree of accuracy attaching to readings below (say) half a candle, there are considerations of colour, diffusive and reflective power, spectrum, and other characteristics not to be ignored in estimating the practical value of a light centre. This goes a long way towards explaining why the public in general attach no value whatever to photometrical readings, but prefer their own impressions, and why the popular idea of a "good" light does not necessarily coincide with that of the photometrist. With all lighting schemes there must necessarily be a certain proportion of excess or waste; the larger the centres, the greater the degree of waste. It may be more economical to employ a larger number of smaller centres, even at higher proportionate cost per light, and lower *average* photometrical value, because they give a larger proportion of *effective* value.

Mr. Voysey directs attention to the importance of minimum value; but average value appears to be the prime factor in his cost estimate. But it is obvious that all excess above the minimum must be waste, unless some special advantage can be shown for it. If 0·1 candle is a satisfactory minimum value, then all light given up to that value is effective, but all beyond is excess. Consequently, 0·2 candle is 100 per cent. and 0·3 candle 200 per cent. waste; and the average candle power does not take account of this fact. The larger the light centre, the greater the proportion of waste light; and therefore I see no reason for altering the opinion I have held and advocated for many years, that street lighting can be more satisfactorily effected by units up to about 500-candle power, than by those which nominally run into four figures. A large light centre gives an uneven and dazzling effect that exaggerates the differences, and makes the maximum lighting appear brighter and the minimum darker than the photometer would show.

Mr. Voysey seeks support for his conclusions from the general statement that a large saving has been effected by substituting electricity for gas and by bringing electricity up to date. Generally throughout the report these totally dissimilar subjects are mixed together. But to be perfectly fair it should be shown (1) how much was saved by substituting electricity, and (2) how much was due to bringing electricity up to date. This is another instance of appropriating credit for general as well as for special advantages. Something might be said on the score of bringing gas up to date, as possibly a greater saving might have been effected by bringing the displaced apparatus up to date than by discarding it. Probably it was not of the best or most effective kind. Bringing up to date includes something besides the introduction of more efficient appliances. The lights and hours of lighting are rearranged with the help of previous experience; and, given a disposition to economize on both sides, a great deal can be done in this direction.

Mr. Voysey not only advocates high-power long-distance lighting, but a return to the primitive days when lanterns were suspended from brackets on the walls of houses or carried on ropes slung across the streets. He recommends an addition to the already cumbersome mass of overhead arrangements. High centre lighting was introduced as a great advance, with the advent of electricity, but was soon found to possess defects such as sharp and black shadows and the irregular effect already mentioned. Even in the early days of gas lighting, brackets on the walls were more generally used than columns; but the fact that they are almost entirely displaced in large cities shows which is preferred. No one except Mr. Voysey has a word to say against the standard or column on the edge of the kerb. It seems rather late in the day to discover that lamp-posts are obstructions. There is no general complaint to this effect. The public do not want the run of the kerbstone, and do not object to larger "obstructions," such as letter-boxes, refuge-posts, orderly-bins, or kiosks, if the footwalk is wide; these being of decided utility in marking the line of the kerb, which is a great consideration in crowded thoroughfares or foggy weather.

Really, there is not much to be said in favour of centre lighting beyond the obvious fact that in theory it is the best means of utilizing 2000-candle lights. To begin with, the suspended centre-light system assumes the existence of buildings 30 feet high or more, on the edge of the road. But in a large proportion of the whole area to be lighted these are not available; and if the scheme was adopted there would still be a good demand for standards, in squares, at crossings and open spaces, in front of crescents, terraces, &c., that stand back from the road, in the neighbourhood of places of worship and other large buildings, or of walls and fences enclosing parks, barracks, recreation-grounds and gardens. But in cases where the two buildings were available, both the public and the property owners would have something to say. If self-contained lanterns supplied with candles or oil were used, the supports might be practically invisible. But gas or electric lamps require pipes or cables; and it would be difficult to arrange the carrying of these up the wall and along the cord to the centre, in a manner that would be sightly or agreeable. One objection that led to the displacement of brackets attached to buildings was the frequent disagreements between the lighting authority and the owners of buildings, many of whom objected to have their property interfered with. What may property owners be expected to say to a scheme comprising the fixing of holdfasts sufficiently strong to keep a wire taut when a large lamp is attached to the centre, and the requisite supply connections are fixed, at a height of 28 feet above ground, and the carrying up of a perpendicular line of pipe or cable from the ground line. In residential districts, which represent the majority of the streets in any large towns, people like the bedroom windows open, for some months in the year at any rate; and a line of 2000-candle lights at about the level of the principal sleeping apartments would not be so appreciated by the residents as it is by Mr. Voysey.

A very strong objection to the centre light is likely to come from the residents and those who use the footwalks, which in nine cases out of ten are the most important part of the thoroughfare. These are neglected altogether by Mr. Voysey; and, so far as he is concerned, the only part to be considered is the roadway between the kerb lines of the footwalks. In business streets, the footwalks are fairly well cared for by shop windows; but at times, when the shops are closed or unlighted, and in residential or other streets where there are no shop windows, more light is wanted on the footwalks than in the road—at any rate, the footwalk wants something better than the leavings from the streets. All that is needed in the road is for approaching vehicles to discern each other or for pedestrians to see their way across. But on the footwalks people require to recognize the characteristics

of those they pass or meet, to see the numbers on the buildings, and the labels denoting the names of streets. In many thoroughfares, the traffic in the road is limited, during the greater part of the hours of darkness, to an occasional cab. The unfortunate pedestrian who loses his way, is unable to locate a particular side street, "canons" against a passer or some obstruction, falls down a flight of steps, or fails to find the required number on a long row or terrace of similar buildings, will not be pacified by the information that the lighting has been improved, and that the minimum between the kerbs is 0·2 candle as shown by the photometer. In streets where there is much vehicular traffic, the whole breadth of the footwalk may at times be in shadow, as when a covered van is passing, near to the kerb. These heavy shadows would greatly facilitate crimes with violence. If the greater part of the light fell on the footwalks, some advantage might be claimed. But this is exactly what does not happen with the centre line of lights. The best-lighted position is the centre line immediately below them, and the footwalks are the worst. Columns or standards, if carried some 28 feet high, are costly; but, when once provided, they require nothing for maintenance beyond an occasional coat of paint. Holdfasts, cords, and extra conduit may be cheaper in the first place, but would call for continual inspection and attention.

In another respect, Mr. Voysey advocates a return to primitive times, and that is in regard to the reduction of the lighting schedule, or partial extinction at midnight—ideas usually classed with entire extinction for five nights at each full moon. Lighting from dusk till eleven o'clock, and none at all on moonlight nights, was the usual rule a century or so ago; and from this the present practice of all-night lighting for 3800 hours a year, as now generally practised, even in small towns, has developed. It is not likely that a return to the old lines will meet with approval. The police do not fall in with such a suggestion. In more than one country town, the opinion of the Superintendent of Police has turned the scale in favour of all-night lighting. The force require to recognize people at a distance, and without disclosing themselves by taking up a position close to a light; and the mere fact of not being able to traverse the streets without risk of recognition is of itself a great deterrent of crime.

In connection with lofty lighting, the question of foggy weather must not be overlooked. The uselessness at such times of lamps on 20-feet posts has been a matter of comment in the public Press; and lights at an altitude of 28 feet would be out of sight altogether. Even a very moderate degree of mist or fine rain would be quite sufficient to considerably reduce the photometrical results at ground level. No kind of light is practically perfect; and electricity is not among the most reliable. With 2000-candle centres, the extinction of one or two lights in a street, through accident or defect, is a serious matter; but with smaller centres no practical inconvenience is caused, and at the same time the facilities for repair are greater.

I would also question the possibility of making a satisfactory and at the same time economical showing, over all the thoroughfares in a large town, irrespective of contour, width, and the character of the traffic, in one size of light only. High-power lights are at a disadvantage in tortuous or narrow streets and lanes; and a thoroughfare of this character, lined with artisans' tenements or small villas, does not require the same degree of lighting as the Strand or Regent Street, London.

REFRACTORY MATERIAL.

By Thomas Holgate, M.Inst.C.E.

The valuable paper contributed by Mr. Bywater to the proceedings of the Institution of Gas Engineers at the last meeting ought not to pass without being made the means of improving our technical practice in the use of fire-clay goods. The subject is so complex that there is need for all the definite information that can be brought forward, so that safe rules may, in due course, be formulated. It will require the co-operation of the clay-worker as well as the user of his products to ascertain all the important facts; and probably it will be found that the former is in a better position for investigating the vagaries of the raw material, while the latter can expend his talents best upon the manufactured article. But such a convenient working division should not preclude surveys of the whole problem, such as the Institution paper generally indicated. In the spirit of inquiry, the writer of this article refers to points in the paper where, to him, further information would be helpful.

After referring to ordinary chemical analyses and rational analyses, the author gives an instance of a Stourbridge clay which did not yield satisfactory fire-bricks, and which failure was not revealed by the ordinary chemical analysis there given. The explanation of the failure I do not find recorded by the author; but I notice a close similarity to the analysis given later in his paper of a clay before weathering. Out of six specific constituents, the first three are identical in percentages; while the chief difference in the remaining three is that, in the latter case, alkalies appear as 1·62 per cent. against 0·62 per cent. of magnesia in the former. What is the explanation of the absence of alkalies in the first instance, seeing that they are invariably present in Stourbridge as in many other fire-clays? Again, what is the interpretation to be placed upon analysis "B"—"Journal" for June 23, p. 883—where the amount of alkalies is 1·04 per cent., but of felspar, from which the alkalies are supposed to have come, only 0·10 per cent. No doubt the apparent discrepancy is due to fluxes present in the impure clay substance; but the rational analysis alone does not disclose this fact, which is of cardinal importance. I can quite see the value of knowing how the fire-clay is built up, and learning therefrom the percentage of free silica (which conceivably acts differently to that which is combined); but unless the ultimate analysis of all the three typical components be given, as advised by Mr. Bywater, then the ordinary analysis, when of a thoroughly complete nature, appears to be the most useful. The emphasis in my opinion ought to be laid upon the fact that many chemical analyses are misleading because they are so incomplete. But even after the analysis is given in the terms of each element; yet there is the state of combination which is unrecorded, and this information will be necessary to a full understanding of how the clay acts in resisting fusion.

I introduce this consideration, notwithstanding that one of the highest authorities upon the subject of fire-clays has said that it does not matter whether potash be present as such, or whether it be there in the form of orthoclase (potash felspar), the important consideration being only its percentage. I do not think, however, that it would be wise in the present state of knowledge to accept this view as final, for there are many indications that the state of combination of any element does affect the degree of fusibility. One instance that appears almost beyond question is that of iron, which is twice as effective as a flux when in the state of ferrous oxide as it is as ferric oxide. Furthermore, as the question of solubility among the ingredients is an important factor in determining the depression of the melting-point of mixtures, and as all compounds of any given element are not equally soluble, it would be imprudent to accept the above-named statement without further qualification.

The considerations aforesaid lead to the point where we can see that both the ordinary analysis and the rational analysis are unable to answer the essential questions, which are, in short: (*a*) What is the state of combination present? and (*b*) What is the influence in depressing the melting-point of this particular component in this particular matrix? This attempt to trace the effect of each constituent is very much complicated the greater the number present, and brings in its train a consideration of the effect of the "common ion" in influencing solubility, as expounded by Professor Walther Nernst. Assuming electrolytic dissociation at high temperatures, and further that solubility among solids is diminished where bodies are present having a common "ion," Professor Alfred Harker, F.R.S., believes that much evidence can be adduced of the operation thereof from the study of rock-magmas. The great similarity between fire-bricks at the time of fusion and the various igneous rocks, immediately before solidification, lends importance to the evidence referred to. He says:

> **In an aqueous solution of salts the water plays a special part, inasmuch as it serves as a medium in which the other constituents become more or less dissociated into ions, while the water itself is little, if at all, affected. We cannot point to any constituent of an igneous rock-magma as playing this passive *rôle*, but it cannot be doubted that there is in such a magma a notable degree of dissociation of some or all of the constituents. This follows from the fact, established by Barus and Iddings, that rock-magmas are conductors of electricity. They showed further that the conductivity is increased by rise of temperature, and that, the most acid constituent (*such as silica or titanic acid in fire-brick*) is the best conductor.**
>
> **[The words italicized are introduced by the present writer.]**

Further, as bearing upon the behaviour of fire-clay at the time of vitrification into fire-brick, and afterwards at the temperature of fusion, it is important to know that Professor Svante Arrhenius has given reasons for believing that at such temperatures, water is an acid capable of decomposing silicates—giving rise to acid silicates and free silicic acid on the one hand, and basic hydrates and oxides on the other. Such a view would imply a partition of acids and bases in the highly-heated mass different from that which is found in the products at the moment of solidification. Such considerations, which apply to the mass at the high temperature of liquefaction, leave untouched the question as to the state of combination in the mass, when the crystallization is imminent. One view of the last-named condition of things is that there is present a mixture of silicate and other compounds identical with those which appear when crystallization takes place.

Another view—that of Professor A. Ledebur, based largely on a study of slags—regards the mass as a solution, instead of a complex chemical compound. He says there is no reason to suppose that, when silica or phosphoric acid are brought into association with lime, magnesia, ferrous oxide, or other substances at high temperatures, the formation of a simple mutual solution of the bodies is impossible, and that much closer combination must necessarily occur. Of course, there is no doubt that certain combinations can occur within a solution, and therefore also within a liquid slag, though, to be sure, these combinations do not come into decided evidence until solidification is proceeding or is complete. The views of Ledebur have been developed by Professor H. Vogt, of Christiania, who finds that fusion of mixtures of solids is a phenomenon following the laws of salt solutions as formulated by Raoult and Van't Hoff, according to which the depression of the melting point proceeds in proportion to the molecular quantities of the various substances dissolved.

Some degree of clarity of mind exists as to the behaviour of the usual fluxes—the alkalies, alkaline earths, iron and manganese

oxides, and titanic acid; but as to the more complex action of silica and the silicates, much more obscurity prevails. A hint as to the nature of this complexity has been given in the quotation from Professor Arrhenius, and may be found further developed in the work of Gustav Tschermak. That experienced Mineralogical Chemist and his coadjutors claim to have proved the existence of a large number of different combinations of silica and water, and that these must exist at high temperatures, or at least associate during cooling, because they exist in the igneous rocks as now found. These hydrated acids have been separated from various minerals, and possess different densities and chemical reactions. If then a fire-brick may consist largely of silicates, which may have widely variable molecular formulæ, so may the operation of the law of the depression of the freezing point be affected.

Various attempts have from time to time been made to formulate a factor of fusibility, with perhaps an increasing amount of success, but with still a large quantity of uncorrelated phenomena. Some idea of the difficulties in the way of propounding a single comprehensive statement may be found in the researches of C. Doelter, who at the Sixth International Congress of Applied Chemistry dealt with the question of "Silicates." These he said might be divided into two groups entirely different from each other, but which may be connected by a series of intermediate bodies. The first group comprises silicates with a sharply defined melting point, small viscosity, high power of crystallizing, and great rapidity of crystallization. They are but little dissociated, and do not show supersaturation or supercooling. To this group belong the calcium-and-magnesium-iron-manganese silicates, as well as the metasilicates of the formulæ, $CaMg(SiO_3)_2$; $CaFe(SiO_3)_2$; $Na_2Ca(SiO_3)_2$. They do not form glasses. To the second group belong those silicates which yield glasses. They possess properties opposite to those of the first group; the most marked being the indefinite melting point—a viscous state corresponding to an interval of temperature of 100° C. and more, separating the liquid from the solid state. The solidifying point is always below the melting point; and practically no heat is absorbed during solidification. To this group belong most of the sodium, potassium, and aluminium silicates. As to the rate of reaction in fused silicates, he says the more complex silicates are usually very viscous when fused, and their rate of crystallization is extremely small. Decomposition into simpler constituents usually accompanies fusion, and owing to the small rate of crystallization, the original compound does not separate from the melt; the simpler compounds crystallizing more rapidly. Lime alumina garnet, "grossular" $Ca_3Al_2(SiO_4)_3$ for example, depomposes into the compounds

$$\left.\begin{matrix}Ca_2SiO_4\\ \text{calcium}\\ \text{silicate}\end{matrix}\right\} \text{ and } \left\{\begin{matrix}CaAl_2Si_2O_8,\\ \text{calcium}\\ \text{aluminium}\\ \text{silicate}\end{matrix}\right.$$

which crystallize out instead of the original garnet. Many other apparently anamalous phenomena in fused silicates are explicable by the small rate of reaction.

Paul Rohland has observed a number of abnormal changes of melting point. He finds that aluminium oxide raises the melting point of pure kaolin; and that the addition of 10 per cent. or less of magnesium oxide (MgO), lime (CaO), potash (K_2O), or ferric oxide (Fe_2O_3) to silicic acid does not affect the melting point at a temperature of about 1500° C. But if a small quantity of aluminium oxide (Al_2O_3) is present, the oxides produce a normal depression of the melting point.

In fig. 5 of Mr. Bywater's paper, the melting point is given at the usually accepted temperature of 1830° C. (3326° Fahr.) for pure silica. Recent investigations in the Geographical Laboratory of Washington, by Messrs. Day and Shepherd, carried out with great care, show that silica begins to melt at about 1600° C. (2912° Fahr.) to an extremely viscous liquid, so that an exact melting point cannot be determined.

Instances could be multiplied, but probably sufficient has been given to show the great complexity of the behaviour of materials like fire-bricks, and also to show the necessity for some means of arriving at a practical conclusion in a simple way. In the opinion of the present writer, it is desirable to have for each sample an analysis as complete as the most skilful chemist can furnish, and for the same specimen should be stated the temperature of fusion under defined conditions. By means of a Fery pyrometer, or else of Seger cones, this information can now be obtained; and gas engineers would be but following the practice of the technologists of the ceramic industry in combining in one statement the twofold essentials. It would then remain to carefully note all physical characters—such as changes of volume under heating, closeness of grain, and the conditions under which the material was used—to enable them to build up in each works a mass of useful data.

—	From Breitscheid, near Hirborn.		From Knöba (Egerland).
	Quality No. 1.	Quality No. 2.	
Silica, SiO_2	45·74	53·78	44·36
Alumina, Al_2O_3	37·84	28·89	37·58
Ferric oxide, Fe_2O_3	1·08	1·08	1·40
Alkalies	0·92	0·84	1·18
Lime, CaO	Trace.	Trace.	Trace.
Loss on calcination	14·54	15·48	15·50
Total	100·12	100·07	100·02
Burns solid, at temperature of Seger cone. No.	1 = 1150°	3 = 1190°	7 = 1270° C.
Fuses at temperature of Seger cone No.	34 = 1810°	31 to 32 = 1760°	34 to 35 = 1820° C.

As an example of the partial application of the method just mentioned, figures relating to three fire-clays examined by Drs. H. Seger and E. Cramer are given—col. 1. Free silica should have been stated separately, as also the titanic acid, usually included in the total silica because of its somewhat similar characteristics; and the alkalies ought to have been more detailed.

In comparing the figures, it is useful to have for reference the melting points of several pure substances allied thereto—

Sodium silicate . . . . Na_2SiO_3 melts at 1007° C. (Kultascheff).
Calcium silicate . . . . $CaSiO_3$,, ,, 1450° ,, ,,
Calcium metasilicate pseudo hexagonal . . . . . $CaSiO_3$,, ,, 1512° ,, Day and Shepherd.
Calcium orthosilicate. . . Ca_2SiO_4 ,, ,, 2080° ,, ,, ,, ,,
Eutectic mixtures; determined by Day and Shepherd.
Tridymite (silica) + the calcium metasilicate at 37 per cent. of CaO (lime) melts at 1417° C.
The metasilicate + orthosilicate at 54 per cent. of lime melts at 1430° C.
The orthosilicate + lime at 67½ per cent. of lime melts at 2015° C.

THE "OMAR" INVERTED BURNER.

YET another pattern of inverted self-intensive gas-burner is now being put on the market; and that it is likely to secure its due share of popularity, one may readily assume after having seen it in action at the Farringdon Road show-rooms of the makers, Messrs. Moffat's Limited. The burner undoubtedly has two great points in its favour, in that it is both highly attractive in appearance and withal offered at an extremely reasonable price. But while so much attention has been paid to these matters by the makers, nothing has been allowed to be sacrificed in the way of efficiency. On the contrary, it is claimed that the admirably diffused light furnished is of as much as 120-candle power with a consumption of no more than 3¾ cubic feet of gas per hour. Turning to the other features of the burner—which is, of course, up to date in all respects—it may be noted that it is fitted with improved air and gas regulators, and detachable steatite mouthpiece and mantle holders; while it is supplied in polished brass or steel bronzed, and can be fitted with bye-pass or distance lighter.

The "Omar" Inverted Self-Intensive Gas-Lamp.

The excellent decorative effect obtainable with the burner is secured by the original construction of the body. The casing, instead of being solid, as with other self-intensive burners, is perforated in the way shown in the above illustration, and is fittted inside with an opal glass collar or chimney. The uses of this glass collar (and which, it may be pointed out, is easily removable for cleaning purposes) are twofold. In the first place, it prevents the heat and the products of combustion from coming into contact with the metal casing, thus obviating tarnishing or discoloration; and, secondly, it allows of light passing through the perforations in the casing, which, in addition to the pleasing appearance it imparts to the fitting, assists in illuminating the upper portions of the room where fixed.

At the last monthly meeting of the Huddersfield Town Council, the minutes of the Water Committee contained a recommendation in regard to the disposal of the balance out of the sum paid by the millowners for promoting the Huddersfield Water Bill of the present year. Included in the account of £724 charged to the millowners was an item of £100 for the services of the Town Clerk (Mr. J. H. Field) and his staff. The sum of £40 had been paid in office disbursements and to the staff for overtime—leaving a balance of £60. It was recommended that £10 should be handed to the Manager of the water-works, and the remainder to the Town Clerk. The Mayor (Alderman Balmforth) read a statement giving a history of the item, and moved the confirmation of the recommendation. Objection was raised that the Town Clerk had been engaged to perform the duties appertaining to the office and whatever came in the way of work, and that therefore he was not entitled to anything beyond his salary. This view was only acquiesced in by five members of the Council; and the recommendation was adopted.

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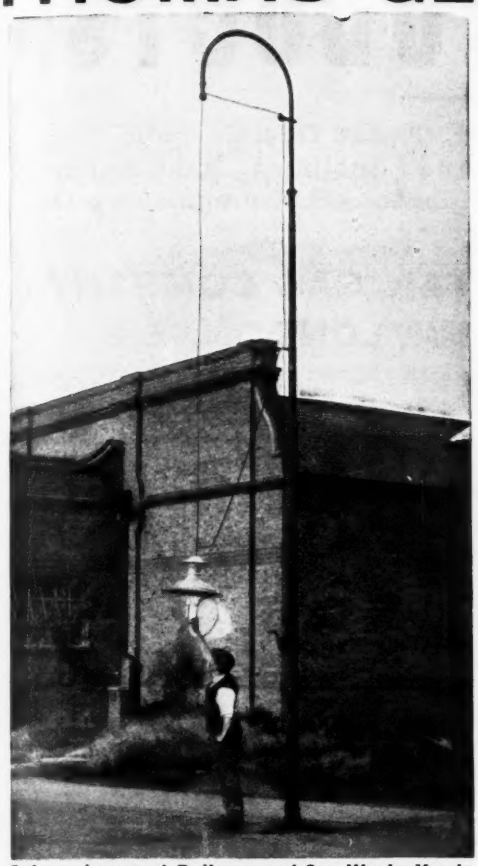

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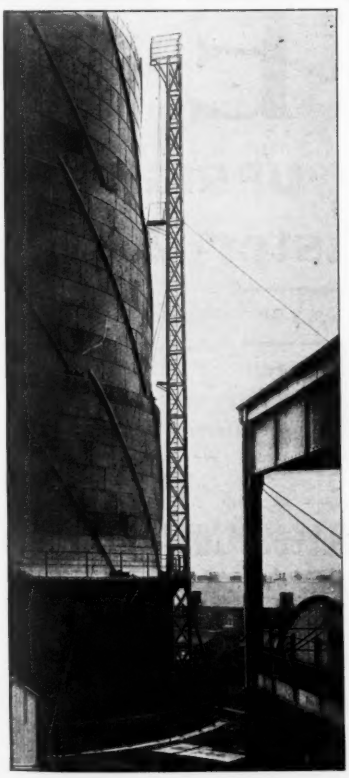
38 to 40 per Cubic Foot.

See "Gas Journal," Jan. 22, 1907, p. 216; "Gas World," Jan. 26, 1907, p. 115.



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ROUND THE WORLD—AND SOME GAS-WORKS.

By Maurice Graham.

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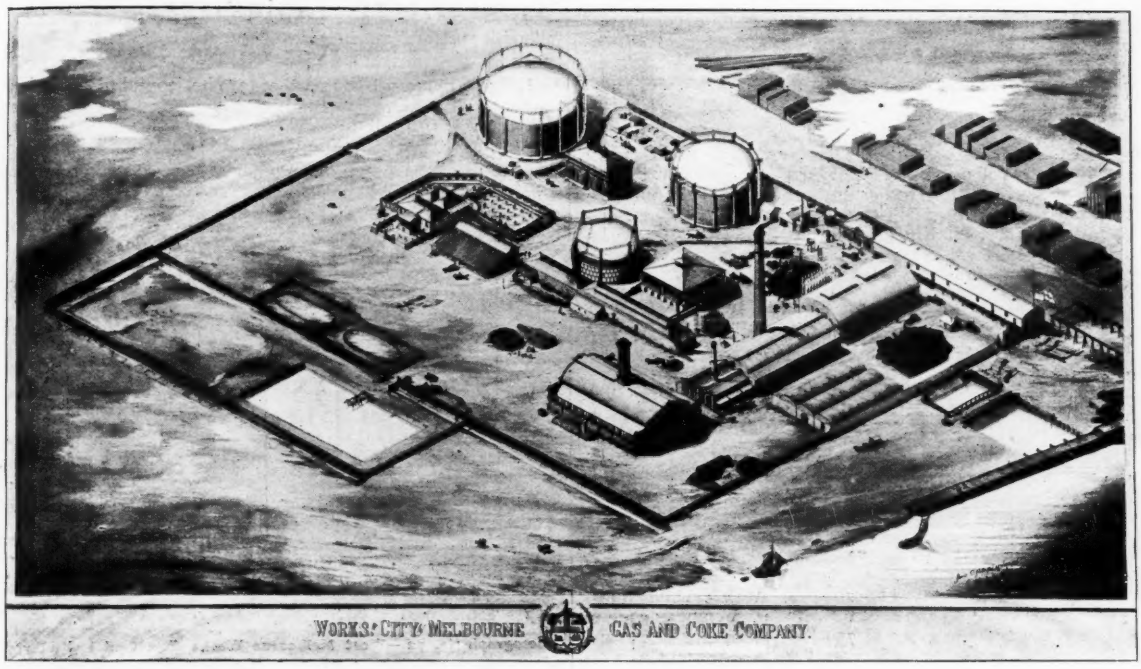
VIII.—MELBOURNE.

Seventy years ago the site upon which the magnificent City of Melbourne now stands was virgin forest. Here pioneer Faulkner settled and made a street of a few unpretentious wooden huts for workers on the land, all gloriously ignorant of the mineral wealth surrounding them. The writer's grandfather Dr. Preshaw (referred to in a previous article) landed on the beach a little way from the centre of the present city. From these beginnings and in this short space of time, "Marvellous Melbourne" (as it is rightly called) has sprung up, substantially built, equipped with all the most modern conveniences of civilization, now ranking as the premier city of the Australian Commonwealth. Its population is about 500,000; and it has cable tramways, gas and electric light works, and a good water supply. A visit during a debate in the Houses of Parliament, and an interview with the Minister of Agriculture, were interesting and instructive. The Hon. Mr. George Swinburne, the Minister of Agriculture, extended a most hearty welcome to the writer. Mr. Swinburne comes, as readers will know, from the Old Country, and belongs to the families of Swinburne and Coates, so well known on the Tyne. He has been

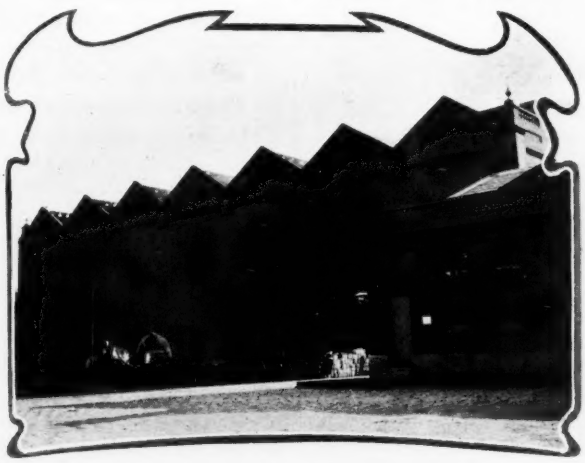


Photograph No. 69.—Isometrical Plan of the Works of the City of Melbourne Gas and Coke Company in 1872.

in Australia for 22 years, and is one of its best known engineers. His engineering work embraces irrigation, hydraulics, electricity, gas, and railways. As Minister, he extends to rich man and farm hand the same courtesy; and the near future will in all probability see him in the high position of Premier of Victoria.

THE METROPOLITAN GAS COMPANY OF MELBOURNE.

Mr. Swinburne, besides governing many gas companies and being interested in many others, is one of the Directors of the Metropolitan Gas Company of Melbourne. The Chief Engineer and Manager of the Company is Mr. P. C. Holmes Hunt, who kindly gave the writer every opportunity of obtaining as much information as possible, and accompanied him through the works. The Metropolitan Gas Company was formed in 1878 by the amalgamation of three old Companies. Photograph No. 69 gives an interesting reproduction of an isometrical plan, dating back to 1872, of the works of the old City of Melbourne Gas and Coke Company. There are now three gas-works belonging to the present Company—the Fitzroy works, covering 7 acres of ground, and making about 400 million cubic feet per annum and 1,250,000 cubic feet as a maximum per 24 hours; the West Melbourne works, covering 10 acres, making about 750 millions in the year and 2,250,000 cubic feet as a day's maximum; and the South Melbourne works of 9 acres, which make about 650 millions annually, and last year turned out 2¼ million cubic feet on the day of greatest make. These three works were visited and will be described.

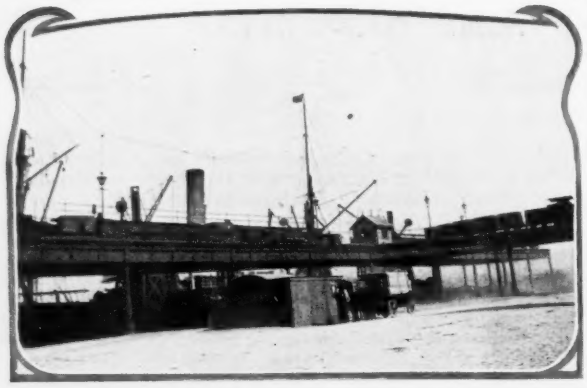


Photograph No. 70.—Fitzroy Works—The Inclined Retort-House.

Fitzroy Works.

Passing the block of offices is seen the large inclined retort-house (see Photograph No. 70). It contains two benches, each with eight beds of seven retorts, or 112 retorts in all. They are 20 feet long by 21 in. by 15 in., tapering to 24 in. by 15 in. They are provided with crushers, elevators and conveyors, storage tanks, measuring-chambers on the "shot-pouch" system, and with Hunt's improved coal charging shoots and furnace chargers. The house, which dates from before Mr. Hunt's management, was evidently built prior to it being decided to have inclined retorts, as the width available on the drawing and charging stages is rather too narrow. Unfortunately, these works are greatly handicapped by the whole of the coal having to be carted to them, whereas the other two works have direct access to the steamers. Any scheme of reconstruction in the future would have seriously to take into consideration the existence of these works.

An old retort-house is now used as a coal store, and contains eight weeks' maximum supply. The atmospheric condensers are covered by a light roof to protect them from the summer heat. The exhauster room, with the boiler-house adjoining, contains two of Gwynne and Beale's exhausters. Crossing a road which here divides the works into halves, there are two tower scrubbers, two "Standard" washer-scrubbers, and two Livesey washers. No naphthalene or cyanide-washing process is adopted. There are three sets of purifier boxes, each set having four boxes, 20 feet square, with water-sealed covers Oxide is used exclusively for purification. The two telescopic



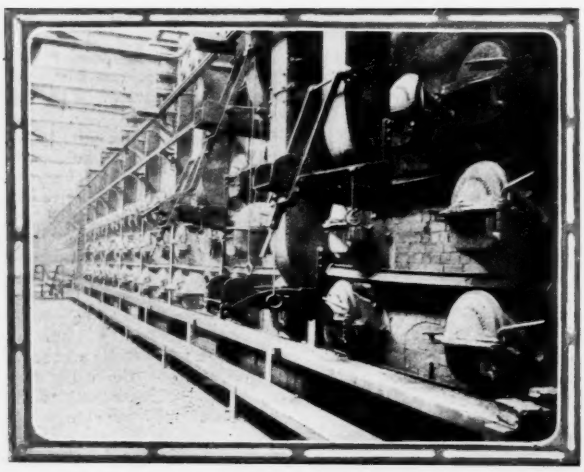
Photograph No. 71.—West Melbourne Works—The Coal Unloading Bridge over the Roadway.

gasholders, one 160 feet and the other 100 feet diameter, contain 630,000 cubic feet of gas.

The sulphate of ammonia plant is being re-designed and reconstructed by Mr. Hunt. All the tar produced is sold under contract; the retail price of it being 7d. per gallon. Enough cannot be obtained to fill the demand, which is chiefly for road-making purposes. No great improvements, except those immediately necessary, can be expected to be made at these works, until a complete scheme has been prepared embodying the working of the entire gas-producing plant.

West Melbourne Works.

These works are situated on the River Yarra, and were passed by the writer when he entered Melbourne by steamer from Geelong. They are about one mile from the city; and the gas from them is distributed principally in the northern suburbs. The coal-unloading wharf belonging to the Company is built on a high staging, and is connected to the gas-works by a bridge spanning the roadway (see Photograph No. 71). Four hydraulic cranes and skips unload the coal direct from the boats, and deliver it into small iron trucks on a narrow-gauge railway, on which they are drawn by locomotives. Photograph No. 72 shows the coal unloading pier and locomotive at work. Mr. Hunt is seen crossing the bridge as he was following the writer. The coal (which comes from Newcastle, N.S.W.) is unloaded at the rate of 120 tons per hour. The whole of the hydraulic equipment for it, including one 60 B.H.P. hydraulic pumping engine, accumulator giving a pressure of 750 lbs. per square inch, capstans and cranes, was made by Messrs. John Abbot and Co., who have done a lot of the work in Melbourne.



Photograph No. 73.—Hunt's Charging Shoots for Inclined Retorts in No. 1. Retort-House.

There are really three retort-houses; but No. 3, which contains 189 horizontal oval retorts, is kept as a stand-by, and serves as a coal store. No. 1 retort-house has 25 beds each of seven inclined retorts, arranged in three benches. They have continuous hoppers, and Hunt's special charging shoots, which are seen in Photograph No. 73. The drawing stage of the same installation is photographed in No. 74, and also shows Mr. Hunt's arrangement for charging the furnaces, which, of course, are on the regenerative principle. In No. 2 retort-house, which has lately been reconstructed, there are 16 beds of horizontal retorts, eight in a bed, arranged in two benches, the retorts being 20 feet long by 21 in. by 15 in. They are equipped with a De Brouwer charger of the self-contained hopper type, with a separate "D.B." pusher. All the fire-clay material in the settings is Australian made and is giving good results; but the regenerators are being improved as opportunity occurs. It may here also be added that the foundations for this retort-house had to be very sound, as the subsoil is treacherous—the site being probably once part of the old river-bed. A bed of reinforced concrete, 204 feet long by 30 feet wide, was therefore put down. The hot coke from the retorts falls into a De Brouwer conveyor, in which it is quenched *en route*, and is carried to the yard, where it is forked into bags, as shown in Photograph No. 75.

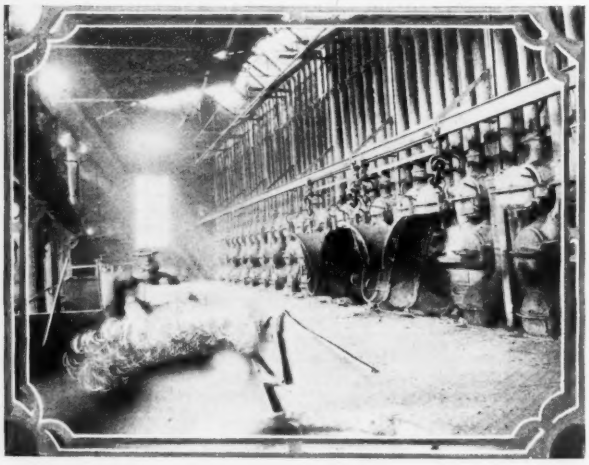
A visit to the electric power house is evidence of the enthusiasm with which Mr. Hunt has tackled this question of power in gas-works. There are two 45 H.P. "National" gas-engines (one being in reserve) which drive a 32 K.W. dynamo. The charger, pusher, and conveyor are all driven electrically. An indicator board, designed by the Engineer, is controlled by the man attending to the coal elevators and coke conveyor, so that starting and stopping can be effected without risk of trouble or breakdown. Mr. Hunt freely expressed his views on electric motors in gas-works. He said that the sooner gas engineers do away with the idea that they must use gas-engines as otherwise offence might be given to their consumers, the better it will be for them. A business man, he said, obtains the cheapest and most convenient power he can for his business.

Leaving the retort-houses, there are horizontal pipe condensers and two of Cutler's water-tube condensers. It may be noted, also, that at the outlet of the holders there are pipe condensers, on account of the great heat in summer. On the north side of

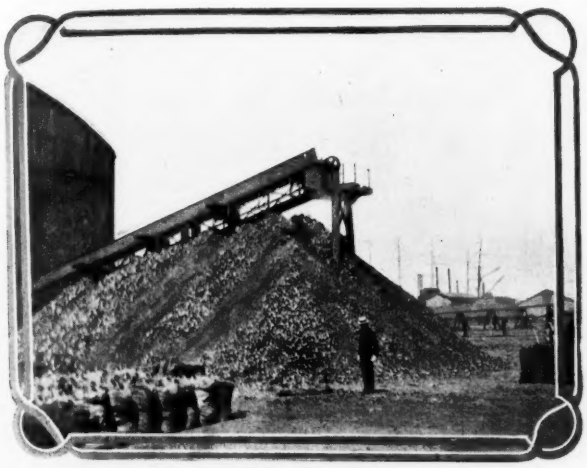
Photograph No. 72.—West Melbourne Works—The Coal Unloading Pier and Mr. P. C. Holmes Hunt.

No. 1 retort-house is the exhauster and engine room. In it, two horizontal engines drive two pairs of Beale exhausters; each pair being of 160,000 cubic feet capacity. The room is nicely arranged, and adjacent to the boiler-house. This contains three Lancashire boilers, 7 feet diameter by 30 feet long. They were, unfortunately, sunk below the ground level when erected many years ago; and this has since entailed extra labour and expense in working. A large brick building near by contains four Livesey washers, two "Standard" washer-scrubbers, and one of Walker's purifying machines. In addition, there are four Dempster tower scrubbers.

No. 1 purifier shed covers six boxes, 51 feet by 42 feet, on the ground floor, fitted with hydraulic power for lifting the heavy covers and for raising the oxide to a floor overhead. No. 2 house contains twelve boxes, 26 feet square, which stand on a steel



Photograph No. 74.—Drawing Stage of No. 1. Retort-House, showing Hunt's Furnace Charger.



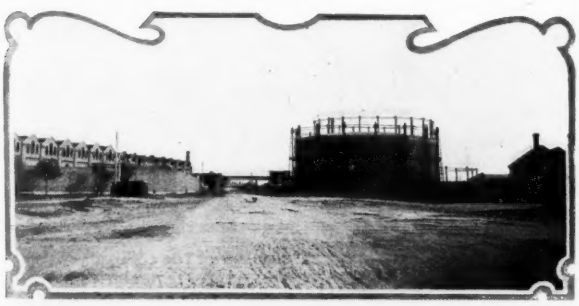
Photograph No. 75.—De Brouwer Coke Conveyor from the Horizontal Retorts in House No. 2.

structural floor about 10 feet above the ground. Underneath is the oxide revivifying floor. Three gasholders provide a storage capacity of 2,000,000 cubic feet; their diameters being respectively 150, 100, and 120 feet. Photograph No. 76 shows the clock tower and offices—the building also comprising the meter, governor, and valves, as well as drawing office, laboratory, and photometer room. A notable feature of these works is the large repairing shop, which is well equipped with machinery to do any class of work, whether large or small.

South Melbourne Works.

Upon approaching these works, the writer obtained a good photograph (No. 77) of them, showing the recently reconstructed retort-house with raised roof on one side, and the gasholders on the other. Inside the works, and in front of the offices, was a lovely garden, which is seen in Photograph No. 78. The illustration also shows the exhauster house, which was being extended to allow of the whole of the electrical plant being covered by one roof and comprised in one house. The offices are lofty and airy and convenient.

There are two retort-houses. One of them is quite small, and contains only five beds of seven inclined retorts, 15 feet long. The other, and main retort-house, contains in its southern portion, twenty beds of horizontal retorts, seven per bed, heated by direct-firing, and worked by Arrol-Foulis hydraulic machines. The



Photograph No. 77.—Approach to the South Melbourne Works.

northern portion proved very interesting; it was being entirely reconstructed for a new installation of twenty beds of horizontal retorts, eight per bed, to be provided with De Brouwer machinery and hot-coke conveyor. Photograph No. 79 gives a view of the work, looking north, and shows the state of its progress in the middle of December last. [The writer was there in March of this year.] A full description will be appearing in due course from the pen of the Engineer and designer; so the writer will content himself with recording how admirably the work is being carried out as it is by the Gas Company's own men. An extra width for the coal-store is obtained by moving the bench nearer one wall of the house; and a conveyor will be installed under the coal-store so as to empty it automatically at any desired point. It is of interest to add that Mr. Hunt is having only one ascension pipe to each retort.

The condensers, exhausters, and scrubbers are similar to those at the West Melbourne works, and need not be further described. There are three sets of four purifier boxes, each 24 feet square, with water-sealed covers, and, as usual, using oxide as the purifying material. Two gasholders are in use—one 200 feet and the other 150 feet in diameter, giving together a capacity of 4,000,000 cubic feet.

It had been reported before that there were to be seen at these works the finest meter making and repairing shops in Australia; and one can certainly say that they are really magnificent. Light and lofty, and 100 yards long by 20 yards wide, they afford employment for a great number of hands. Opposite to them is a building of the same size, divided into compartments for repairing cookers. Mr. Hunt has decided on a new design of standard cooker, and the Company are shortly about to make it themselves in their own shops. In this connection, it may be said that at the end of 1907, there were 11,700 gas cookers on hire.

GAS DISTRIBUTION.

Having visited the three works, Mr. Hunt the following day kindly drove the writer all round the city and suburbs, and gave him much information relating to the distribution and consumption of gas. The number of consumers reaches about 55,000, and the total length of the mains about 800 miles. There is no high-pressure distribution; but there is a system of mains from the three works to what are called "out-stations," of which there are also three. From the Fitzroy works, there is an 18-inch main about 3 miles long which goes to the Richmond out-station, where there is a gasholder of 300,000 cubic feet capacity filled by exhausters placed at the holder. The Hotham out-station is similarly supplied through a 24-inch main, also three miles in length, from the West Melbourne works; the Hotham gasholder being of 3 million cubic feet capacity. A holder of the same size is placed

Photograph No. 76.—Clock Tower and Offices at the West Melbourne Works.

at the Tooronga out-station, and receives its gas from the South Melbourne works through a 24-inch main, which is about 6 miles long.

The standard illuminating power of the gas is 15 candles; no enrichment is necessary. There are contracts with thirteen local Municipalities for public lighting by incandescent gas; the total number of public lamps attended to by the Company being about 5750. The City of Melbourne proper is lighted by flame arcs; but this is explained by the fact that the City Council own their own electricity supply undertaking, and therefore no gas lighting is allowed in their streets. Light for light, however, gas is about four times as cheap as electricity.

COMPLAINT DEPARTMENT.

That gas consumers are well looked after by the Company is evident from the organization that is specially devised to meet their requirements and to attend to their complaints. Two years ago the Inspection and Complaint Department was re-organized, and is now working so well that all complaints are attended to the same day they are received. To insure this, the whole area of

Photograph No. 78.—Garden in Front of the Offices—The Exhauster-House facing is being extended.

Photograph No. 79.—Twenty Beds of Horizontal Retorts in Course of Construction—December, 1907.

supply is divided into five districts, each in charge of a foreman and containing a number of depôts, which are in direct telephonic communication with the head office, from which the complaint men work. There are 73 foremen and fitters engaged in this work—all under a chief complaint inspector, who is under the Stove and Fittings Superintendent. There are also stove inspectors who systematically carry out a free adjustment of stoves on the consumers' premises. Then there are 54 men who fix fittings purchased from the Company's show-rooms.

The prepayment meter department is a separate and growing one. The slot installation consists of a griller, pendant, one or two brackets, and one incandescent burner with a free mantle every six months. The meter is adjusted to give 15 feet for 1d. Installations are at present being put up at the rate of about 70 per week, and the work employs 42 fitters and boys.

The mains and service department is looked after by about 90 men. The area is divided into two districts, northern and southern, with an inspector over each. Altogether about 1000 men are employed by the Company. The gas-engines connected to the supply at the end of last year numbered 850.

All these facts and figures indicate the prosperity and development of the Gas Company in Melbourne. The increased gas consumption during the last two years has been about 9 per cent. Also from the description and photographs given, it will be gathered that considerable reconstruction has been, and is being, carried out. All this devolves upon Mr. Hunt, who tackles the work and handles the concern with the greatest confidence, ease, and success. The Directors of the Company are to be highly complimented upon having chosen, and having in their service, so hard-working, earnest, and conscientious an official—the worthy son of a worthy father.

The writer also here wishes to acknowledge his great appreciation of Mr. Hunt's kindness and courtesy and hospitality to him when in Melbourne; and for the full and interesting information he proffered and for some of the photographs reproduced. This article is merely intended to give the general impressions of a visit to the gas-works of Melbourne. It is hoped and expected that Mr. Hunt will himself describe in fuller detail the interesting and important work which he has designed and is carrying out at the present time.

INFLAMMATION SPEEDS OF GAS MIXTURES.

Dr. A. Nägel, of the Engineering Laboratory of the Technical High School at Dresden, has been conducting some instructive experiments on the inflammation speeds of gas mixtures such as are used in internal combustion engines; and the results are epitomized in the current number of "Engineering."

In the case of coal gas and producer gas, the writer found that at high gas percentages the initial pressure, ranging up to 8 atmospheres (114 lbs. per square inch), influenced the speed of the inflammation only slightly. In mixtures of low gas concentration, the initial pressure had a distinct influence. The greater the pressure, the slower the flame travelled. In an 8 per cent. coal gas and air mixture, the flame went out again, and the combustion was not complete even after ten explosions. The speeds observed in coal gas were: 0·5 metre (20 inches) per second, or less, in 8 per cent. gas; 1·5 metres (5 feet), or less, in 11 per cent. gas; and from 3 to 4 metres (10 to 13 feet) in 16 per cent. gas. When the temperature of the gas mixture to be exploded was raised to 75° C., this speed rose in one case from 3·5 to 3·8 metres. In the poorer mixtures, the initial temperature (15° or 75° C.) mattered little. In the producer gas mixtures of 30 per cent., the speed was about 0·5 metre per second; going down to half this value, or less, as the initial pressure was increased to 8 atmospheres. The producer gas mixture of 46·5 per cent. gave a speed of 2 metres (6 ft. 6 in.) or more. At the initial temperature of 15° C., it was in the latter case 1·95 metres per second, and at 75° C. 2·1 metres.

Determinations of the calorific power of the coal gas, undiluted with air, in a Junkers calorimeter yielded 4297 calories per cubic metre; while the producer gas yielded 1183 calories. The 8 per cent. coal gas would thus have had a value of 343 calories, and the 30 per cent. producer gas one of 355 calories. The two mixtures had, therefore, approximately the same calorific power; yet greater speeds were obtained in the producer gas, probably on account of its methane content. Comparing the producer gas of 46·5 per cent. with the coal gas of 16 per cent., the heating value of the former being about 550 calories and that of the latter 687 calories, it was found that the flame travelled at the rate of 4 metres per second in the coal gas, and at only 2 metres in the producer gas. In the 24·5 per cent. hydrogen, having a heat value of about 600 calories per cubic metre, the flame travelled at 12 metres per second.

In discussing the results of these experiments (which are to be continued), Dr. Nägel refers to the uncertainty of the temperature estimates. He says the first ignited gas particles will be compressed after ignition; the last before being fired. The final temperatures will be very different. Heat conduction and convection, dissociation, and radiation will diminish these differences; but in gas-engine cylinders of irregular shape they will be considerable.

The Mayor-Elect of Huddersfield—Alderman John Holroyd—has done good work on the Water Committee of the Corporation. He is now the Managing-Director of Messrs. J. Holroyd and Co., Limited, dyers and dry cleaners; but he was formerly a journeyman joiner. He claims that when he is elected as Chief Magistrate he will be a "working man" Mayor.

UNITED MEETING OF ENGLISH JUNIOR GAS ASSOCIATIONS.

Visit to the Franco-British Exhibition.

Last Saturday had been eagerly looked forward to as the occasion of the second joint meeting of the English Junior Gas Associations, which was appropriately fixed to take place at the Franco-British Exhibition. In point of size, the gathering fell far short of that which was seen at the Manchester Gas Exhibition last November; but one reason for this, of course, was that it had to be held (owing to the impossibility of engaging the Congress Hall for a more suitable date) during the holiday season, while a further explanation might perhaps be found in the fact that Manchester was more readily accessible to the majority of the members. As it was, however, some fifty members of the Yorkshire and Manchester Junior Associations reached London at six o'clock in the morning; and the number would have been nearly twice as large had it been possible for a day excursion to be arranged from Birmingham. Unfortunately, the main body of the members of the Midland Junior Association could only come up by an afternoon train; and as this reached the exhibition nearly two hours behind time, the forty members who came by it did not arrive until the business meeting was over.

When the early morning contingent reached London, they found themselves faced with a full day's programme. They were met by Mr. W. J. Liberty, President of the London and Southern Junior Association, and Hon. Secretary of the Reception Committee (who had worked hard to make the meeting a success), Mr. H. Rothwell, Senior Vice-President of the Association (who had been previously deputed to visit the various Associations and arrange for the gathering, and who had also devoted much time and trouble to the matter), and Mr. P. Smithers, of the Gaslight and Coke Company. After breakfast at Reggiori's Restaurant, opposite King's Cross Station, a drive through London was commenced at eight o'clock, and, with the stoppages recorded below, lasted until early in the afternoon. The visits paid were greatly enjoyed by the whole party, who were warmly received everywhere. In fact, as Mr. Liberty subsequently remarked, they were met all round by good kind friends. The day's proceedings throughout went without a hitch of any kind; and for this thanks are due chiefly to the gentlemen already named and the other members of the Reception Committee — Messrs. W. Upton, S. A. Carpenter, and L. F. Tooth, and the Secretary of the London Junior Association, Mr. J. G. Clark. Mention should also be made of Mr. Rosevere, who spent the whole day, in his capacity as a Steward, in looking after the comfort of the visitors.

There were present at the meeting, Mr. Liberty, the President, and Mr. J. G. Clark, the Secretary, of the London Junior Association; Mr. E. J. Wellens, the President, and Mr. J. Alsop, the Secretary, of the Manchester Junior Association; and Mr. J. H. Hill, the President, and Mr. C. T. B. Roper, the Secretary, of the Yorkshire Junior Association. Mr. W. E. Caton, the President of the Midland Junior Association, wrote deeply regretting his absence, owing to his being on the Continent; and Mr. W. Upton, Past President of the London Junior Association, also wired that he was unfortunately prevented from being present. Mr. James Hewett, the Secretary and President-Elect, was with the members of the Midland Junior Association, as also was Mr. A. O. Jones, Vice-President.

At the conclusion of the general meeting in the Congress Hall, at which the members were privileged to hear an address by Mr. Henry E. Jones, a joint Council meeting was held, at which Mr. A. L. Holton, of the Manchester Junior Association, was appointed Permanent Secretary of the United Councils of the Junior Associations—a step which may be taken as clearly pointing to close combination and continuity of work. It was also resolved to send to the Mayor of Wigan a letter of sympathy with the efforts he is making for the relief of those so sadly stricken by the Maypole Colliery disaster, and to the widows and families a vote of condolence in their bereavement. A resolution was passed thanking Mr. Liberty for the expedition he had used during the day, which had enabled not only the long outside programme to be carried out, but also the conference and the joint Council meeting. The next joint meeting of the Councils of the United Associations will take place in Manchester next February.

A Morning of Visits.

The first visit paid was to the new fire station at the junction of Queen Victoria Street and Cannon Street, which was reached at 8.30, and for an inspection of which Mr. Liberty had secured permission. There was, of course, here a great deal to interest the party from a general point of view, in the latest designs of fire appliances; and they were also able to see something which appealed particularly to them professionally, inasmuch as, while in the station, the engines are kept day and night under a pressure of 20 lbs. of steam, by means of gas-jets under the petrol-fed boilers. The jets are attached to flexible tubing.

The Davis Gas-Stove Company.

Close by are the show-rooms of the Davis Gas-Stove Company, which the members reached by 9 o'clock—the hour scheduled on the programme. A busy time was then spent inspecting the various appliances, under the guidance of Mr. H. J. Davis, Mr. Morgan, Mr. W. S. Gilbert, Mr. R. Francis, and Mr. G. Goatley. Mr. Davis welcomed them, on behalf of himself and his fellow-Directors, and drew special attention to the firm's screwless gas-cooker, with which he said the cost of maintenance had been reduced to a minimum.

A demonstration was given by a fitter, who took to pieces and put together again one of these screwless cookers in a very short space of time. In this cooker, it may be remarked, all screws in the body are entirely dispensed with. The whole body is locked, and held firmly together with four long bolts; the nuts passing from top to bottom at each corner. The brackets supporting the hot plate are so fixed as not only to give additional strength, but also to enable the whole of the top of the oven to be covered with the sliding enamelled tray. The hot plate is hinged and locking; and the burners are all loose, but are locked in position when the hot plate is down. There was seen in operation a large hot-plate, with automatic gas lighting and lowering arrangement. There is a bye-pass; and when a utensil is placed over one of the burners, it depresses a lever and so turns the gas on—the reverse operation taking place on its removal. There are taps fitted, in addition, for regulating the gas. There were to be seen large cookers, &c., for hotels and such places; and considerable attention was given to a new hot closet for fitting on cookers, so as to utilize the waste heat from the oven. This heat is conducted by a flue at the back into the closet, for keeping plates or food hot; and when the oven is not in use the closet can still be heated, as there is fixed beneath it a burner with a flue up which the heat passes. The "Rapid" water heater, in which the gas is lowered automatically, was seen in action, as also was the firm's new No. 57 "Diamond" gas-fire. This fire is of very nice design, and was much admired. It is ornamented with polished cast brass festooning, and has a wide fire space and powerful heating chamber. Other points are that it is fitted with a removable brick, loose burner, single-row fuel arrangement, and the Davis patent gas and air regulator, while the gas supply may be taken in at either side. With a 15-inch fire, the consumption is stated to be about 37 cubic feet of gas an hour, at the average pressure; and certainly an excellent heat is given by it.

Refreshments having been partaken of, Mr. E. J. Wellens, the President of the Manchester Junior Association, proposed a hearty vote of thanks to Mr. Davis, the Company, and the staff, for the manner in which they had received them. They had, he said, gone to a good deal of trouble in showing them the latest cookers and other appliances. As Mr. Davis had said, the maintenance of gas-cookers was a very important thing for the gas industry; and the simpler such things could be made, the better. The vote was briefly seconded by Mr. E. J. Sutcliffe, Past-President of the Yorkshire Junior Association, and carried unanimously; and Mr. Davis suitably acknowledged it.

Messrs. George Glover and Co.

The drive was then resumed to the meter works of Messrs. George Glover and Co., at Chelsea, where the visitors were received by Mr. J. W. Glover, the Managing Director, and Mr. Albert Glover. Here the former gentleman, after heartily welcoming them, explained the working of the dry meter, the manufacture of which is the firm's speciality. While the party were partaking of the hospitality that was provided for them, they were able to listen to a lucid description of the principles on which the meters are constructed.

By a coincidence, the half-yearly conference of representatives of the Richmond Gas Stove and Meter Company had been held at the works the previous day; and these gentlemen were therefore at hand to assist in welcoming the members, who were also in this way afforded an opportunity of viewing some of the latest of the goods designed by the firm for the utilization of gas.

An inspection of the works (some illustrated particulars of which were given in the "Journal" for Nov. 26, 1907, p. 643) was then made, though time did not permit of as long a pause in all the numerous shops as would otherwise have been desired. However, there was to be seen the whole process of manufacturing meters, from the pressing of the tin cases and the stamping out of the brasswork for the indices, &c., to the soldering-up of the finished article. The departments comprise repairing and hand-made meter shop (meters over 10-light size are hand made), stamping shop for the parts of the smaller meters, leather shop, automatic meter shop, brass shop for ordinary meters, case making and finishing shop, painting shop, foundry, testing shop. All the motive power for the presses, lathes, and air blasts is derived from gas; two 20-horse power engines being used for the purpose. Richmond crucible furnaces are used with great advantage for the melting of the metals; and in the tinmen's stoves gas is employed instead of charcoal.

Before proceeding round the works, Mr. R. H. Garlick, Treasurer of the Manchester Junior Association, said that, in anticipation of the treat he was sure they were going to be afforded, he would like to propose a hearty vote of thanks to the firm for the way in which they had received them, and especially to Mr. J. W. Glover for the clear explanation he had given of the dry meter. Mr. G. W. Fligg, Past-President of the Yorkshire Junior Association, who seconded the proposal, remarked that he was an oldish man in the gas business, and within his memory the firm's name had always

been to the forefront in the matter of dry meters. The vote was heartily accorded; and in acknowledging it, Mr. Glover remarked that Mr. H. M. Thornton, the Managing-Director of the Richmond Gas Stove and Meter Company, had hoped to be present. He had, however, wired regretting his inability to do so, and wishing them all a pleasant and profitable day in London. Mr. Glover added that if on a future occasion when they had more time at disposal any of those present cared again to visit the works, he would be pleased to see them.

Gaslight and Coke Company's Show-Rooms.

Proceeding on their journey, the party next made a stop at the Kensington show-rooms of the Gaslight and Coke Company, where, in the absence of Mr. F. W. Goodenough, the Chief Inspector, they were received by Mr. E. Pilbrow, the Inspector in Charge. Assistance in pointing out the features of this magnificent depôt was rendered by Mr. H. Rothwell, Mr. E. G. Merry, Mr. W. J. Freeman, and Mr. J. W. Gibbons; and it may be said here that an illustrated description of the show-rooms was given in the "Journal" for Nov. 27, 1906, p. 593, while the suite of rooms which had been fitted up in the window space were similarly noticed in the issue for June 2 last, p. 571.

Before returning to the brakes, Mr. Liberty remarked that they were all deeply indebted to the Gaslight and Coke Company, and to Mr. Pilbrow, for their visit to these wonderful show-rooms. Mr. F. Thorp, of the Manchester Junior Association, proposed a hearty vote of thanks to the Company and Mr. Pilbrow; remarking that the show-rooms were more like an exhibition than anything else—perhaps not quite equal to the Manchester Exhibition in some ways, but superior to it in others. The ventilation, for one thing, was wonderful, considering the number of appliances in use. Mr. C. T. B. Roper, the Secretary of the Yorkshire Junior Association, seconded, and remarked that he thought everyone would have seen there something which he had never come across in operation before. The vote was cordially agreed to; and in reply Mr. Pilbrow said Mr. Goodenough would be very pleased to hear the kind words that had been spoken.

Mr. William Edgar's Lamp-Works.

Another stage of the drive was then undertaken, to Mr. William Edgar's lamp-works at Hammersmith, where Mr. Edgar was awaiting the visitors to show them round, in which he was assisted by Mr. A. Sinclair Jopp, Mr. H. Wright, Mr. A. H. Bristow, Mr. W. E. Hutchings, Mr. G. J. Eve, Mr. R. Cotes, and Mr. F. Cotes. Mr. Edgar, in welcoming the members, said he would be pleased to see them again on some future date, when they might be able to spare more time, because there were there hundreds of little things which would probably interest them. As a slight memento of the occasion, he would ask them to stand in a group so that a photograph could be taken.

Some time was spent in looking over the works, in which were being made numerous articles of interest to the visitors. In the glass warehouse, large quantities of globes, &c., are stocked; and near by is the outside lamp shop, where tin and copper lamp frames are made and put together. Some "Caxton" street-lamp frames, adapted for inverted burners, were being manufactured, and attention was drawn to the patent porcelain enamel reflector, which is easily kept clean. A large shop is devoted to painting and glazing; and at one end of this is situated the drawing office. The other parts of the works visited included the smiths' shop, where all the wrought-iron cradles, frogs, are made, and other ironwork is turned out; the packing-room; the fitting-up shop for inside and outside lamps; the brass shop, containing lathes and stamping and other machines; the foundry; the stores; the finishing shop; and the show-rooms. As the works are on the river bank, they are advantageously situated; for goods can be brought up either by barge or rail. Special attention was directed to the "Eclipse" indoor lamp for inverted burners—with three lights only for indoor use; but in the outdoor pattern it can be had for one, two, three, four, or six burners. A lamp of the same name for upright incandescent burners has been on the market for some time. All the power on the works is obtained from a "National" gas-engine of 13-horse power; and the brass foundry, which is in the basement, and contains two furnaces, is ventilated by a Keith and Blackman fan. The offices are on the first floor; while at the top of the building there is a warehouse where stock is stored, and a photometer and testing room. The visitors saw a "Blenheim" fire in action, and could satisfy themselves as to the claim that it is absolutely silent.

Further light refreshments having been partaken of, Mr. A. L. Holton, late Secretary of the Manchester Junior Association, and Mr. J. Alsop, the present Secretary, moved and seconded a vote of thanks to Mr. Edgar—the first-named gentleman referring to the great number of small things there were to be seen, and Mr. Alsop eulogizing the works. Mr. Edgar, in reply, said the concern was a child that he was proud of; it was his own creation. He started the place with a man and a boy only a very few years ago.

The last stage of the drive was then undertaken, and the visitors found themselves at the Franco-British Exhibition, where a party of about a hundred (among whom was Mr. Henry E. Jones) sat down to lunch in the Tourist Room. At the conclusion of the meal, a move was made to the Congress Hall, where the meeting subsequently took place.

The Meeting.

The united gathering took place in the afternoon in the Congress Hall at the Franco-British Exhibition; the chair being occupied by Mr. W. J. Liberty, the President of the London and Southern District Junior Gas Association. The attendance would have been larger than was the case, but unfortunately the members of the Midland Junior Association—who subsequently came in a body about forty strong, under the leadership of Mr. James Hewett, the Secretary and President-Elect (the President, Mr. W. E. Caton, being absent on holiday)—were delayed on the railway, and did not arrive till after its conclusion.

Mr. Liberty said that Mr. H. E. Jones had kindly consented to address the meeting; and he would at once ask him to do so.

Mr. Jones, who addressed his audience as his comrades in the great industry of gas, and his friends, said he was not quite sure what his title was to address them and occupy their time when they were in the midst of such charming surroundings as was the case that day. But perhaps it might be two-fold—first that he happened to be the Chairman of the Gas Section of the Engineering Exhibition in the Machinery Hall; and, secondly, that he had been a worker in the same ranks as themselves for the past forty years—in fact, he thought he might almost say forty-five years, for he began very young. However much he would like to seize this opportunity, as an old man retiring from the fight and meeting face to face so many younger men who would have to go on with the struggle after he had left it, so much did he esteem the honour that had been paid him by allowing him to address them at all, and so much did he appreciate the opportunity, that he was full of misgivings that he might waste the precious moments—and they could not be more than a few moments—in addressing them. They were assembled in a wonderful exhibition; and when they had been round it, and seen it lit up after dark, they would agree with him that its beauties were fairy-like. He was well aware that the illuminations would show them a great deal of the sister art of lighting by electricity; but there would nevertheless be some very brilliant lighting by gas for them to see. In other directions, also, they had around them superlative attractions. There was a magnificent exhibition of paintings both French and English—old masters and modern—and there was splendid machinery of every sort to engage their attention in the Engineering Section. Therefore, however pleased he might be to stay there and talk to them, he must endeavour to compress into a few words what he had to say. First, he would congratulate them, and himself, on the progress of their great industry, which went steadily along. They no longer supplied merely light, but fuel and power in all directions. The progress which chiefly struck him in the latter part of his long experience had been the introduction of the Welsbach mantle, which had revolutionized all lighting, and that wonderful device the prepayment gas-meter, which had increased the consumers of many undertakings by two and three fold, and even more. Then the introduction of carburetted water gas had made them to a certain extent independent of the price of coals; while there was now, in large works more especially, to be seen what did not exist for many years after he began his career—the regenerative system of heating, by which the power of the retorts and of the whole works was much increased. The new conditions of retort-house labour which had arisen from the use of the regenerative system, had led to the introduction of machinery for charging horizontal retorts; and of such machinery, the De Brouwer was perhaps the most popular form to-day—certainly it threw the coal well into the retort. There was also the inclined retort, which had so many followers in all parts of the world; and now they were promised by Mr. Harold Woodall a vertical retort. Vertical retorts were, of course, already in existence—on the Continent chiefly; but the special charm of Mr. Woodall's invention was that it was intended to carbonize continuously, without interruption. If they would consider for a moment the immense importance of preserving that temperature in the retort which was best suited for producing from the coals the various products—gaseous, liquid, and solid—they would realize the advantage of Mr. Woodall's proposal. In a system by which there was placed into a retort enough coal to last for (say) a six-hours' operation, and at the completion of this period there was withdrawn the residue in the shape of coke, the burden on the heating power of the furnace was too great at the beginning and too small at the end, and so they were reducing the temperature too much at the time of charging, whereas later on there was a surplus of heat which was injurious. Therefore they would see at once that any system—whether the vertical, the inclined, or the horizontal—which would hour by hour feed in the necessary proportion of coal and hour by hour remove the requisite amount of coke, would accomplish an enormous step in the employment of heat in the destructive distillation of coal. Most works nowadays gave more attention to the residuals than they did when he was young. In the year 1869, when he went to the Ratcliff Gas-Works, the ammonia return was so poor that he increased it five-fold the first year he was there. They did not then manufacture it into sulphate of ammonia, which was done now in the smallest sized undertakings. Again, very many works now converted their tar into some of its leading products; and they would see by the exhibit of the Gaslight and Coke Company in the Gas Section, how they carried this further still. They would notice how

largely, by a marvellous series of further products from tar, the gas industry entered into all kinds of processes; and they must not forget, also, how they assisted in eliminating the gold from the tailings at the mines by means of cyanide. He believed before long—so valuable were the products of which this familiar tar was the parent they would all be carrying on the process of reducing the tar at any rate to three things—benzol, which was useful for their own purposes, and for motor-cars; creosote, which was valuable for preserving timber and other materials from corruption; and pitch, which was daily employed now for mitigating dust and improving the condition of roads. Then another great change in their system was the employment of higher pressures. They were supplying gas all day for power and cooking; and it was necessary to preserve pressures in the daytime four times, and at night five times, as great as was the case in his youth. This, however, had not increased the leakage. They would see a great deal of electric lighting in the exhibition; and electricity did, of course, lend itself to decorative effects which were not easily attained by gas. He used to see at the Vauxhall and Cremorne Gardens and other places, the higher parts of the buildings lighted with little oil-lamps of various colours, while the lower portions were similarly illuminated by small gas-lights. But though gas was not employed to illuminate the outsides of the buildings of this exhibition, it nevertheless served a very useful purpose. Nowadays, great attention was being paid to the development of the use of gas for power and heating. In fact, the pipes in the streets in the daytime, when not used for lighting, were taking the place of horses and carts carrying fuel to people's doors. They might not, in the Gas Section of the exhibition, notice anything very striking in the matter of engineering; the exhibit was directed rather more to the commercial side than to the purely scientific side. They would find a highly attractive illustration of the domestic uses of gas, showing the economy and comfort to be derived from the employment of this commodity as much from the fuel as from the lighting point of view. There was a laundry in operation, round which a throng of people was always to be seen. Then, among other things, they would see the De Brouwer charging machine, and also displays of fire-resisting materials by the retort-makers. There were also dotted about gas-producers; and although these employed not quite the gas they made—except when they manufactured water gas—they must nevertheless regard them as encouraging very much their own industry. Though when used on a very large scale producer gas might perhaps be cheaper than theirs, still the working of the engines showed people what could be done with gas; and then they would think a long time before they put in producer gas plant of their own. They might have noticed that there had been serious complaints about what had been said to be the insanitary condition of the lavatories at the exhibition; but someone had remarked in "The Times" that the cause of the trouble was nothing in the world but the sulphuretted hydrogen from the producer plant just outside the Machinery Hall. Great interest had been taken in the exhibition by the King and the Royal Family; and next to the wonderful genius displayed by Mr. Kiralfy in evolving so fairy-like a city from what was a few months ago a sea of mud or grass plain, the most remarkable thing was the way in which capital and philanthropy had been attracted by the scheme. Many really most beautiful things had been sent from private collections; the English and French marine exhibits, he thought, excelled anything that had ever been seen before, while another very interesting exhibit on the French side was that from the Krupp gun works. In fact, it was not a matter of an hour or two, but of days, to really do the exhibition justice. He would conclude his address by repeating an anecdote he heard when he went out with the Institution of Civil Engineers to Canada and America some four years ago, during the time of the St. Louis Exhibition. A gentleman who was going to give an address said he would not speak long, because he recollected a hint given to a friend of his who asked another friend to tell him after he had made an important speech at a meeting what he thought of it. It lasted about twenty minutes; and the speaker had devoted great attention to it. The friend said, "It was very good; but a wise man would have said all you said in ten minutes, and a still wiser man would not have said it at all." He thanked them for their attention; and remarked that it showed they were very loyal to the common cause if they could come out of the sunshine to listen to a worn-out old gentleman like himself.

Mr. J. H. Hill, President of the Yorkshire Junior Gas Association, in proposing a hearty vote of thanks to Mr. Jones, said they had all enjoyed very much the remarks that he had made; and they were very greatly obliged to him for all the trouble he had taken to come and point out to them the features of the exhibition which it was most necessary for them to notice. As Mr. Jones said, they used in times gone by to carry out illuminations with gas which were then considered to be very grand; but now the electric people did it, and they were crowing. They had brought out an Exhibition Number of the "Electrical Bulletin," and said they were not at all sorry that gas had just a little bit of a show, as evidence of the antique things that were still on the face of this earth. He just happened to meet with a gentleman in the Australian Section who was an electrician, and was acquainted with Mr. Wigglesworth, the General Manager of the Perth (W.A.) Gas and Electricity Works, who went from York. He said that if it had not been for the electricity, the works would have been nowhere at all; that electricity was everything in Australia—they "could not be bothered" with gas. "Bothered" struck him as being rather a good word. Why, the lighting of the grounds at the exhibition by the Keith high-pressure system was ten times better than that of the parts illuminated by electricity; and it was only necessary to go to Kingsway and Aldwych to see the finest examples of street lighting at the present day. Then, again, gas had the question of cost and other things on its side. He was glad to be present that day. It was a grand thing to know the Junior Associations had so closely combined. It had taken the Senior Associations a long time to get an *entente cordiale* between them; but the Juniors had performed the feat in a very little while. They began these combined meetings at Manchester; now they were in London; and he hoped soon there might be another similar gathering somewhere else, with someone as wise in every way as Mr. Jones to speak to them.

Mr. E. J. Wellens, President of the Manchester and District Junior Association, who seconded the vote, remarked that he wished to express the thanks of the members and their appreciation of the honour of having an address from Mr. Jones that afternoon. They had had a long programme to get through; and so far everything had gone off satisfactorily. Mr. Jones had referred to the members present as those who would have to carry on the fight; and at the meeting in Manchester, Mr. Thomas Newbigging had said: "We look especially to our rising aspirants (particularly the younger ones) to the position of gas engineers and managers for maintaining the better traditions of our important industry. Young though many or most of you are, the responsibility resting on you is very great." Well, the Juniors were anxious to do all they could in this direction; and he thought the fact that they had come that day from Yorkshire, Manchester, Birmingham, and different parts of London to be addressed as they had just been, showed that they had some ambition to maintain the position which had been ascribed to them. Some nine years ago—in November, 1899—the Manchester Junior Association visited the Maypole Colliery, Wigan; and in view of the sad calamity that had taken place there, he suggested that they should send a letter of condolence with the sufferers, which would show that the Manchester members had not forgotten their visit to the pit.

Mr. Liberty said they would all like to hear a few words from Mr. Grafton, the founder and first President of the London and Southern District Junior Gas Association.

Mr. W. Grafton remarked that it gave him great pleasure to be present and to show his sympathy with the movement. He was surprised to see that from a few members of the Regent Street Polytechnic, such a large gathering had grown. The results had far exceeded his expectation. In the course of his speech, Mr. Hill had referred to the word "bother." He wanted all young gas men of the future to have no such thing in their system. If gas was to prosper, they must not make anything a bother, but must do it with a heart and with a will. Electricians made no bother of their work; neither must gas men. He had on his holidays visited many gas-works; and he had sometimes found "bother." He would just like to refer to the section of the exhibition of which Mr. Jones was the worthy Chairman. He thought there was not sufficient representation of what the cooker could do. There was a good deal of furniture about; but there was not enough demonstration of the capabilities of gas, and it was in this direction that he would like to see a little more earnestness of purpose. They were all grateful to Mr. Jones for coming there that day; and he trusted the Provincial members would go home with a lasting impression of their meeting in London.

Mr. Liberty said if it had not been for Mr. Jones the exhibition would have been very barren indeed as far as gas was concerned—in fact, he might say absolutely barren. Those present were now juniors; but it had often been remarked that the juniors of to-day would be the seniors of to-morrow. It was for them to say whether or not this should be the case. The gas industry, like many another, was no longer a close profession; it was open to all who desired to enter it, and possessed the necessary brains. Even the path from the school to the university was now open to the boy who wished to go there; and so was that from the workshop to the manager's office. He believed that the outcome of such meetings, and such Associations as they had growing up among them, would be that the open pathway to which he referred would in the future be very well trodden indeed. They saw that afternoon the force of consolidation; and he hoped that in a short time all the six Junior Associations—the Scottish as well as the English—would be welded together with a definite purpose to send the gas industry forward as it had never been sent forward before. He was, however, not now going to deal with that. It would come up in due season. They had now to thank Mr. Jones for coming and giving them the address he had just delivered.

The vote having been enthusiastically carried,

Mr. Jones said he was very glad indeed to be among them. He would be a poor creature indeed if, with the reminiscences of his own youth—when he worked very hard for only moderate remuneration—he was not always ready to hold out his hand, or both hands, to the younger members of the profession and industry that had carried him fairly well so far. It was always the privilege of the older man, when it was in his power, to give to the younger man that aid or assistance which time had put him in a position to give—whether from experience or in any other manner. They must not go away without thanking their worthy friend Mr. Liberty, who had arranged all the proceedings so well. They would agree with him that Mr. Liberty did that which was

the first essence of all projects—put his heart into the matter, and put his shoulder to the wheel. They knew Mr. Liberty so much better than he did, that it would be waste of time to use terms of eulogy; but he was sure from the way in which the meeting had been organized that they had a good and faithful friend in Mr. Liberty.

Mr. HILL remarked that they ought to join with the vote of thanks to Mr. Liberty a similar compliment to the other members of the London Association, and particularly to the Council, for the manner in which everything had been done.

The vote was carried by acclamation.

Mr. LIBERTY, in returning thanks, said he was very young yet in his year of office; but he would endeavour before its conclusion to deserve all the kind things that had been said. In the meantime he would pass on the vote to his colleagues who had been working so earnestly with him.

The meeting then separated; the members proceeding first to the grounds to be photographed, and then to the Machinery Hall, where Mr. E. Pilbrow, who is in charge of the Gas Companies' exhibit, was waiting to take them round the Gas Section and entertain them at tea. Subsequently, in small parties, the visitors inspected the high-pressure gas lighting and as much of the other portions of the exhibition as was possible in the time that then remained at their disposal. Amid such varied surroundings and attractions, the evening was, it need hardly be remarked, spent in a most enjoyable manner.

ESTIMATION OF VOLATILE MATTER IN COAL.

Dr. A. Berthold, of Bochum, has described in a recent number of the "Journal für Gasbeleuchtung" some researches which he has made on the laboratory determination of the yield of coke and volatile matter in coal. The original method of Muck was to heat 1 gramme of coal in a platinum crucible, with lid supported 3 cm. (about 1·2 in.) above the top of a bunsen burner giving a flame 18 cm. (7·2 in.) in length. The heating was conducted until gases ceased to be evolved. This method has been modified by subsequent analysts, with a view to defining the conditions more precisely, and thereby obtaining more uniformly consistent results. Dr. Berthold refers to some of this subsequent work, and then goes on to show that both the dimensions and the weight of the platinum crucible employed affect the results to a very considerable extent. For instance, using three different crucibles, ranging in diameter at the mouth from 33 to 40 mm., in height from 38 to 46 mm., and in weight from 20·1 to 27·6 grammes, he found that the same coal, heated in a flame varying in height from 9 cm. (3·6 in.) to 29 cm. (10·8 in.), gave from 80 to 86·82 per cent. yield of coke. After discussing the probable causes of the variations observed, he comes to the conclusion that for estimating the yield of volatile matter and coke from the coals as used on gas-works, a comparatively small crucible is the best; and he suggests the following as standard conditions for the estimation—viz., that the crucible shall be 19 mm. wide at the base, 33 mm. wide at the top, 38 mm. high, and weigh approximately 20 grammes; and that the crucible shall be supported 3 cm. (1·2 in.) above the top of the bunsen burner of which the flame, when burning freely, shall be at least 18 cm. (7·2 in.) in height.

Such conditions, according to Dr. Berthold, give the maximum yield of gas from the coal, and the results obtained are as nearly as may be in agreement with those afforded in carbonization in gas-works' plant. For determining the probable yield of coke when the coal is carbonized in coke-ovens, he prefers to use a larger and heavier crucible, which he finds gives results more closely resembling those obtained in coke-oven practice.

THE REMOVAL OF SULPHURETTED HYDROGEN FROM COAL GAS.

Herr F. Bössner, the Chemist of the Vienna Municipal Gas-Works, has published, in the "Zeitschrift des Vereines der Gas- und Wasserfachmänner in Oesterreich-Ungarn," some notes on dry purification. He points out that the extraction of sulphuretted hydrogen by means of hydrated ferric oxide is a purely chemical process, the essence of which is that the reactions proceed under definite quantitative relations—that is to say, a given quantity of sulphuretted hydrogen always requires the same quantity of ferric hydrate for its absorption. Similarly, the revivification of the fouled oxide by means of air is a chemical process. When continuous revivification *in situ* is practised, these two processes proceed side by side. Notwithstanding the revivification, however, it is not possible to purify unlimited quantities of gas by means of a limited quantity of ferric hydrate; for the reasons that the revivifying process proceeds more slowly than the formation of ferric sulphide; that the liberated sulphur encloses the active hydrate; and that the heat evolved dries the material and cakes the particles of sulphur.

Hitherto great importance has been attached to the rate of flow of the gas through the purifying material; and on the Continent Kunath's researches, made in 1886, and the rules founded upon them, have been generally followed. These researches have been referred to recently in the "JOURNAL" in connection with the efficiency of Herr Lux's purifying material. (See Vol. CI., p. 223.) Briefly, Kunath concluded that in laying out the plans for purifiers the cross section should be made such that the rate of flow of the gas would never exceed 0·20 inch per second; and that if in the course of time the vessels no longer sufficed, when worked in series, to fulfil this condition, two or more vessels should instead be worked in parallel. Kunath also concluded that purification was not determined by the number of vessels working in series, nor by the depth of the layers of material, but only by the cross section of the smallest vessel. Mr. Newbigging, in the fourth edition of his "Handbook," published shortly before the results of Kunath's investigations, gave figures which make 0·22 inch per second the permissible rate of flow through three purifiers worked in series. Nevertheless, it may be said that Kunath drew false conclusions from his investigations, and that these false conclusions continue to prevail with the majority of gas engineers to the present day. If the rate of flow of the gas were the one indispensable condition for proper purification, there should be a close interdependence between this rate and the chemical process of the extraction of sulphur. Modern chemistry has introduced the conception of the velocity of the reaction—that is to say, when two substances capable of reacting on one another are afforded opportunity to react, they are spoken of as not being in chemical equilibrium. After a certain time has elapsed, they attain this chemical equilibrium, or, in other words, new bodies are formed, in such quantity and of such nature as the reaction between the materials in question determines.

It is now held that it is not the time required for the exchange of the atoms which determines the time necessary for the establishment of chemical equilibrium, but the time which is available for the two or more molecules which are about to react to come together. They are brought together either by the movements of the molecular groups themselves, as with gases and solutions, or by the artificial bringing of the groups into contact, as when gas is driven through purifying material. If a number (x) of small cubes of oxides are placed in a row and the same quantity of gas is passed over them in the same time, in one case lengthwise, and in the other case crosswise, it will be seen that in the former the velocity of the gas will be x times greater than in the latter case, and there will be only opportunity for one xth part of the number of impacts of the molecules of the gas on each cube of oxide. Hence the total number of impacts must be the same in the two cases, and, therefore, the same quantity of gas will be purified by the oxide whichever direction or course it takes through it. Contrary to Kunath's deduction, the purifying effect must be independent of the rate of flow of the gas through the material.

This deduction from theory is supported by the results of experiments made by E. Merz, in 1903. He took three experimental sets, each containing three vessels of which the area differed very greatly in the three sets. The depths of the vessels varied inversely as their areas, so that the same amount of purifying material could be put into each. Gas was passed through each of the three sets at the same rate of flow, and the experiment was repeated three times, the rate of flow being widely different each time. It was found that in all cases the purifying effect was the same, and that consequently the variation in the rate of flow, and the variation in the shape of the purifying vessel, in no way affected the work of purification. The same purifying effect was attained from the same volume of purifying material whether the gas passed through it slowly or rapidly. In the inferences drawn from Kunath's researches, regard was not paid to the fact that he increased the rate of flow by increasing the quantity of gas passed through the material in unit time. His experimental purifier thus had to deal with more or less gas according as the rate of flow was increased or diminished. The differences he observed in the purifying effect were, therefore, due to the variation in the quantity of gas rather than to the variation in the rate of its flow. Kunath's conclusion, that with vessels worked in series it is only the cross section of the smallest vessel which signifies, appears to be completely untenable. Each vessel will purify according to the quantity of material it contains and its condition, quite independently of the others. It may be concluded that the purifying effect of a mass of oxide is the same whether the gas is passed through it in its shorter or longer direction, but the quantity of gas must not be altered for the same quantity of oxide.

Many gas managers attach great value to oxide being laid in the purifiers in one body, instead of being broken into layers by grids. In order to ascertain what foundation (if any) existed for this preference, the author made experiments by passing gas at the same rate of flow through two U-shaped tubes of equal size, one of which contained a given quantity of oxide unbroken by any diaphragms or grids, while the other contained the same quantity of oxide broken into layers by three or five diaphragms, each nearly equal to the cross section of the tube, and pierced by only a small central hole. It was found that the oxide was fouled at the same rate in both the tubes, and the gas began to show dirty at the outlets of both when approximately the same quantity of gas had passed through them. It would thus appear that the intermittent diminution of the cross section by the three or more diaphragms had no influence whatever on the purifying effect of the material.

The author's general conclusion is that it is the ratio between the quantity of gas and the quantity of material which primarily is the determining factor in the purification of gas. The rate of flow of the gas only comes into play in so far as it may affect unfavourable conditions of pressure.

INVERTED HIGH-PRESSURE GAS-LAMPS FOR PUBLIC LIGHTING IN BERLIN.

By Professor H. Drehschmidt.

Some particulars of the lecture on this subject, which Professor Drehschmidt delivered at the meeting of the German Association of Gas and Water Engineers in Berlin in June last, have already been given in the general report of the proceedings at that meeting. The full text of the lecture has, however, now been published in the "Journal für Gasbeleuchtung;" and, in view of its importance, we give a (slightly) condensed translation of it.

Good illumination of streets and open spaces is an imperative necessity in the interests of traffic and safety in towns. As the traffic becomes greater, the degree of illumination must be increased. Some time ago, it appeared as though electric arc lighting was ordained, by reason of its high lighting power, to take the first place in fulfilling these requirements, and that gas lighting would be forced to give place to it. In Berlin it was first realized, through the high-pressure upright gas-burners installed in the lamps in the Alexanderplatz and the Alexanderstrasse, that gas lighting could still compete successfully with the electric arc lighting. Competition led to improvements in both modes of lighting. The electricians believed they would succeed with flame arc lamps. The latter, however, had various faults. For example, the colour was unsatisfactory, they were unsteady, and the light was unfavourably distributed, while the cost of upkeep was increased. Nevertheless the high illuminating power and the economy of current cannot be contested.

In Berlin, the brilliant lighting of the Potsdamerplatz and of the square facing the Brandenburg Gate, effected by two columns each with three or four flame arc lamps, was regarded by many as an irrefutable demonstration of the superiority of electric lighting. The upright incandescent gas light, even with high-pressure gas, had the disadvantage for such purposes that the greater part of its light was directed upwards and only the smaller part made available for lighting. Even when reflectors were applied, which diverted downwards a part of the light radiated upwards, loss of light was necessarily incurred. The inverted incandescent gas-light, however, directed the greater part of its light to the place where it was required, and at the same time yielded more light than upright burners for the same consumption of gas. As a consequence, inverted gas-lamps at ordinary pressure were tried for lighting in the Invalidenstrasse. The result was so good that it was decided to try to apply high-pressure gas to the inverted burners in order to obtain lighting of high power which could be used in streets where the traffic was heavy. It was assumed that the streets and squares having the heaviest traffic would require lamps consuming 2·4 cubic metres (84·76 cubic feet) of gas per hour, and those with less heavy traffic lamps consuming half as much; and that each lamp would need two burners.

The Selas Light Company offered for the purpose inverted lamps which were supplied with the Selas mixture of air and gas. Trials were made with these in the laboratory of the Corporation gas-works. As, however, the ordinary low-pressure inverted burners had proved to have at least as good an efficiency as the upright Selas lamps, the trials were soon extended to compressed gas pure and simple. The results of these trials demonstrated that such gas gave quite as high a lighting duty as the mixture of air and gas. High-pressure gas alone had the advantage over the mixture in that the pipes required could be of smaller sizes, and that the compressing plant was smaller and simpler; while there was the possibility of more extended application. The firm of Ehrich and Graetz, of Berlin, were thereupon asked to provide burners to compete with the Selas burners. Another well-known firm was at the same time approached, but did not respond to the suggestion, and has only latterly begun to take an interest in the matter. After two years' experimenting with the lamps of the two firms, a start was made at introducing them into the streets. The changes made during this experimental period were the results of experience gained in the laboratory of the Corporation gas-works.

In regard to the lamps, the general points to be observed are as follows: The burner, mixing-tube, and head, which are exposed to great quantities of hot products of combustion, must be very strong and massive, so that they will not become red hot. In order to avoid overheating, in one of the lamps a large number of metal ribs are introduced to conduct the heat from the lower part of the mixing-tube to a massive outer ring. In the other lamp, air is led from outside round the burner, through hollow metal ribs, and then rises and mixes with the combustion products. The dimensions of the mixing-tube and burner must be chosen so that the most favourable result is obtained from a gas consumption of 600 to 1200 litres (21·19 to 42·38 cubic feet) per hour. The end of the mixing-tube or mouth of the burner cannot be closed, as in upright high-pressure gas-burners, by a simple metal gauze, as this would very soon be destroyed. Instead, specially-shaped rolled sheet metal set on edge was used, with massive perforated plates of refractory material or metal. The burner-tubes must be readily replaceable, as they are the parts that suffer most from the heat. The nipples of the burners also must be easily detachable for the purpose of removing soot and dust. In one lamp the nipples are accessible when the lower part of the metal casing is raised; in the other, they are exposed on turning a lid which covers an opening in the casing. The supply-pipe and nipples as at present placed within the metal casing suffer from the great heat. Dissociation of the gas and deposition of solid particles may occur in the supply-pipes, and the screw-threads of the nipples become damaged. It is therefore intended in subsequent lamps to put these parts outside the metal casing.

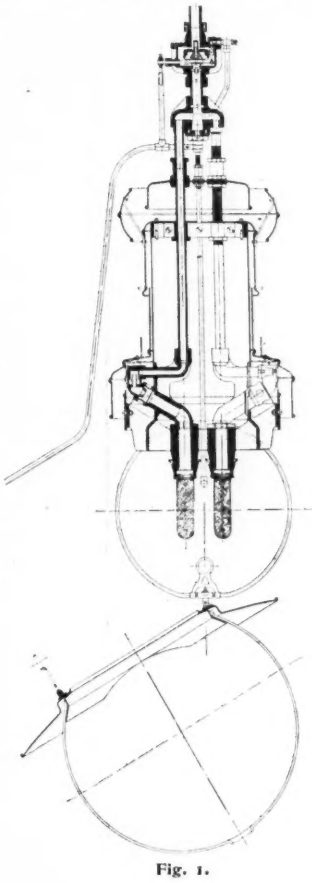


Fig. 1.

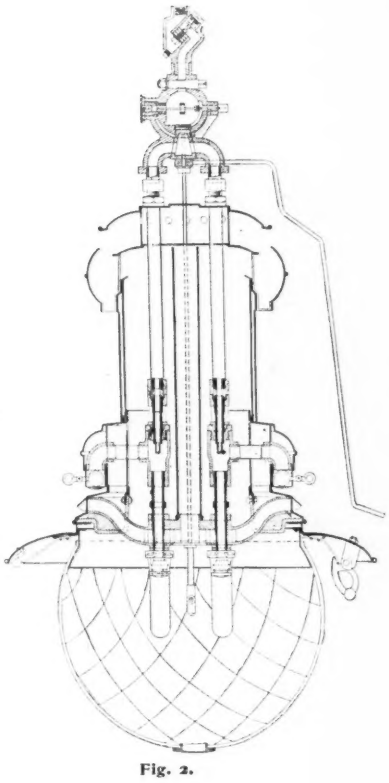


Fig. 2.

A lamp has been constructed on these lines; but trials of it are not yet completed. In one lamp the primary air supply passes close to the lower wide part of the metal casing and directly through the air inlets of the burner-tube; in the other, the air inlets are special tubes closed with gauze and provided with regulators. The secondary air has to be supplied in such a manner that it is not affected by wind. The air passes under the widened ring-shaped lower part of the metal casing upwards, and then again downwards into the globe. The secondary air must enter the globes in one direction, in order to prevent the lamps roaring when burning; and it must reach all sides of the mantles, as the highest emission of light is attained in this manner. Consequently, there can be no wide structural parts in the middle of the lamps; otherwise the air would be diverted sideways. The manner in which the products of combustion are carried off also greatly affects the resistance of the lamps to the influence of wind. An inch or so above the cylindrical metal casing, there is a metal cap or head. The exit so provided for the combustion products is then further protected by an outer rounded metal ring. Gusts of wind entering this outer casing then pass out either above or below, and they do not oppose the products of combustion. The general arrangement of the two types of lamps will be seen from the sectional drawings, figs. 1 and 2.

The selection and testing of mantles for use with these burners occupied a long time. There is one main difference from the inverted burners using gas at ordinary pressure. Between the mouth of the burner and the mantle of a low-pressure burner there has to be a free space by which the products of combustion may escape, in order that the maximum illuminating power may be developed. With high-pressure lamps, on the other hand,

the mantle must come close against the mouth of the burner, as in this case the combustion gases must be driven through the mantle. The mixture of gas and air issuing from the mantle already contains nearly sufficient air for the complete combustion of the gas. Until recently, double mantles, incinerated and shaped on a special apparatus, were used. The highest illuminating power was produced with such double mantles. The light from the inner mantle penetrated the meshes of the outer; and the luminous surface of the two, even when one was within the other, was greater than that of a single mantle. At first, the mantles used on the high-pressure lamps had a very short lifetime—even only a quarter to half an hour. They broke away close under the iron ring by which they were attached to the nozzle of the burner; and as the fracture always occurred in the same place, the reason of it was sought for. The mantles had remained soft at this place because they had not here been subjected to strong heat. An attempt was made to overcome this fault by saturating the burners at the point of support, and a little way below it, with a binding composition; but as the mantles were long, and there was considerable loss by breakage in conveying them to the lamps after burning-off, an attempt was made to burn them off on the lamps themselves.

The lamps are provided with arrangements for lighting them from a distance, actuated by the pressure of the supply. The jets which are alight in the daytime ignite the gas which is turned on to the burners when the pressure goes up at night, and are then themselves extinguished. It was attempted to burn-off and shape the mantles by the flame produced as soon as the pressure was put on; but at first very badly shaped mantles resulted. They were narrow at the top and bulbous below, with the result that the illuminating power, which depends so much upon the proper shape of the mantles, was considerably diminished. This defect was also cured; a proper shape being secured by a special form of nozzle for the burners. The whole of the mantles were then burnt-off in this manner. It was found, however, that these mantles were much shorter than those previously used; they had shrunk considerably more, and had become closer. Having regard to what has been said on the greater illuminating power of the double mantle, it seemed that if the single mantle was burnt-off on the burner, and so was made closer, it would have a greater luminous surface per unit area than formerly, and so would be likely to give as high an illuminating power as the double mantle. Trials supported this impression; and it was found as a fact that the illuminating power was somewhat higher than that of the double mantles. Single mantles were consequently tried experimentally; but they were found to be much more liable to fracture. The fracture again occurred at the point of support; but a remedy for this trouble was found by turning over inwards the upper part of the untreated mantles on the supporting ring to somewhat below the support. The possibility of thus using single mantles resulted in considerable economy in the cost of lighting.

A start was made at bringing the lamps into use last Christmas, which, needless to say, was a difficult time for trying any new method of lighting. It was very soon apparent that, apart from the initial interruptions incidental to any new equipment, the lamps with two burners, each of which consumed 600 litres (21·19 cubic feet) of gas per hour, behaved well. The lamps, however, with burners consuming double this quantity of gas—which differed from the former only in the burners and not in the size of the lanterns—used up a good many glass globes. Larger globes which would be less exposed to the destructive action of the heat could not be had, so that this fault could not be avoided in this manner. The mantles and flames of these larger burners were very long, and the lower ends came close to the globes. It was thought likely the illuminating power would not be diminished if the mantles were shortened and the two burners each consuming 1200 litres (42·38 cubic feet) were replaced by three burners each consuming 800 litres (28·25 cubic feet) of gas. This was found to be the case on trial; and fracture of the globes was thus avoided. The illuminating power was somewhat higher, and there was a better dissemination of the light laterally. The whole of the two-burner lamps of 2400 litres (84·76 cubic feet) consumption, which had been installed chiefly in the Königgrätzerstrasse and Potsdamerstrasse were then replaced by three-burner lamps.

In regard to the utilization of the gas in these new inverted lamps, it is to be remembered that for street lighting and most other purposes only the light projected downwards, whether with or without the aid of reflectors, comes into account. The consumption of gas in the three-burner lamps, consuming 2400 litres (84·76 cubic feet) per hour, amounts in favourable cases to 0·65 litre per hefner (39·6 candles per cubic foot) mean lower hemispherical illuminating power. It varies somewhat according to the quality of the mantles used; but the mean lower hemispherical illuminating power for the 2400 litres (84·76 cubic feet) consumption is about 3700 hefners (3365 candles). The lamps consuming 1200 litres (42·38 cubic feet) per hour, with two burners, have of late been somewhat neglected, on account of the unfavourable experiences with the larger two-burner lamps; but their duty, according to the measurements hitherto made, is somewhat lower—viz., about 0·75 litre per hefner (34·72 candles per cubic foot). These figures seem quite satisfactory, if it is borne in mind that they refer to the average, and not to the maximum, illuminating power. The three-burner lamps in certain directions give a light of 4000 hefners (3635 candles).

The distribution of the light, however, is of almost equal importance with the mean illuminating power. It may be that a lamp of low mean illuminating power may give a better illumination than one of high average illuminating power, because of the different distribution of the light. The most interesting point is, how gaslight compares in this respect with electric light. In the annexed diagram (fig. 3) are shown curves of the distribution of the light of the three-burner inverted gas-lamps, the ordinary electric arc light, and the flame arc light. These curves do not indicate the absolute illuminating power, but only the manner in which the light is distributed for each kind. They are intended to demonstrate the difference in the distribution. The inverted gaslight affords the greatest lateral dissemination, and the flame arc lamp the smallest. The former is, therefore, best for lighting large places, and the latter the worst. This distribution of the light indicates also that electric lamps require to be suspended at a greater height than inverted gas-lamps, and consequently there is a lower utilization of the light produced by the former.

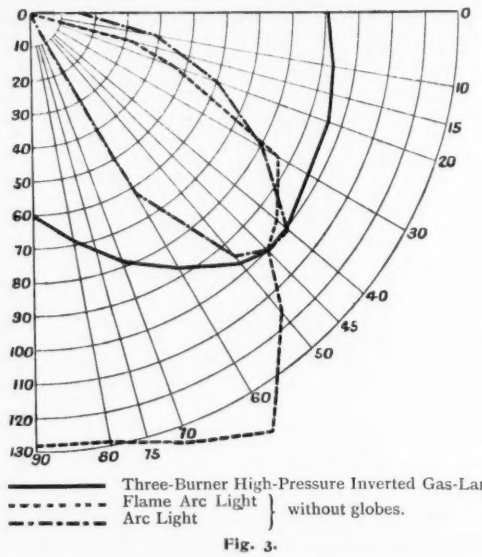


Fig. 3.

Lighting with high-pressure inverted gas-lamps in Berlin—in particular in the Königgrätzerstrasse and the Potsdamerstrasse—has aroused great interest and has been highly approved. There is a strong public demand for the replacement of the electric lighting of the Leipzigerstrasse and Friedrichstrasse by this method of gas lighting. The general public probably regards the latter as a new method of electric lighting. Indeed, a Munich journal reported a short time ago, in dealing with the opening of an exhibition in that city, that the electric lighting was extremely good; whereas, in fact, the lighting was by high-pressure inverted gas-lamps.

In order to be sure that there was a substantial basis for the impression that the street lighting by means of inverted gas-lamps was better than by arc lamps, photometric measurements have recently been made in the Berlin streets. The comparison was between the high-pressure inverted gas-burners in the Potsdamerstrasse and the flame arc lamps in the Potsdamerplatz. Fig. 4 shows the result obtained for the illumination of a horizontal surface at standing height above the pavement; while fig. 5 shows the illumination of vertical surfaces both in the line of the street and across it. The vertical illumination, in the author's opinion, is very important in regard to the proper lighting of streets, especially for facilitating the recognition of people, inscriptions on vehicles, and placards in the streets. This is contrary to the views of electricians, whose lamps give a smaller illumination of vertical surfaces because of their being suspended at greater height and affording a smaller lateral dissemination. The figures for the horizontal illumination in the Potsdamerplatz are taken from Bloch's measurements. In the line of the lamps, both the electric and gas lamps show strong differences in the illumination afforded; but in the middle of the streets, the gas lighting is quite uniform. The maximum illumination in the line of the lamps in the Potsdamerstrasse (gas) is 191 lux; and in the Potsdamerplatz (flame arc), 82 lux (16·235 and 6·97 foot-candles respectively). In the middle of the Potsdamerstrasse (gas), the illumination is from 21 to 31 lux (1·785 to 2·635 foot-candles); while that of vertical surfaces in either direction is quite uniform and high. The different curves show illuminations of from 13 to 41, from 9 to 24, from 8 to 15, and from 26 to 30 lux. In the Potsdamerplatz, measurements of vertical illumination had not been taken; but measurements with the flame arc lighting at the Bradenburg Gate make it appear highly probable that the iliumination of vertical surfaces by the similar lights in the Potsdamerplatz is lower and far less uniform than that by the gas-lamps in the Potsdamerstrasse.

A few words may be said as to the manner in which the compressed gas lighting is carried out. In the two compressing installations—one in the Waisenstrasse and the other in the Gitschinerstrasse—there are altogether ten compressors, having

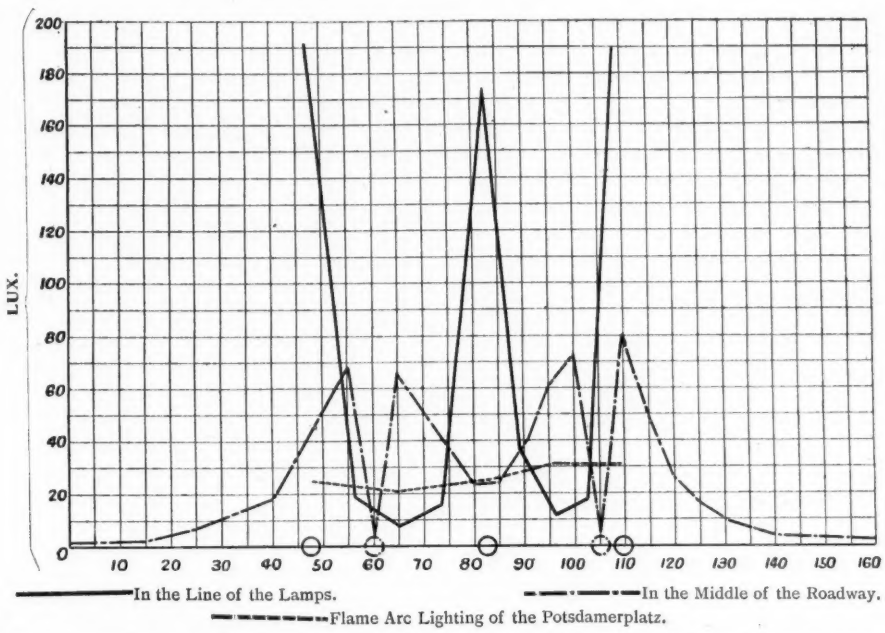


Fig. 4.—Illumination of a Horizontal Surface—High-Pressure Inverted Gas-Lighting in the Potsdamerstrasse.

an aggregate capacity of 2920 cubic metres (103,125 cubic feet) per hour. The apparatus which is used for choice is the "Millennium;" but there are also two small compressors of 100 cubic metres (3530 cubic feet) capacity of the "Pharos" and "Colonia" patterns. There are 234 lamps consuming 2400 litres (84·76 cubic feet) per hour, and 531 lamps of one-half this consumption. The lamps are supported at a height of 5·3 metres (17 ft. 6 in.). The number, however, is to be greatly increased very shortly; and the streets with most traffic are to be provided with them.

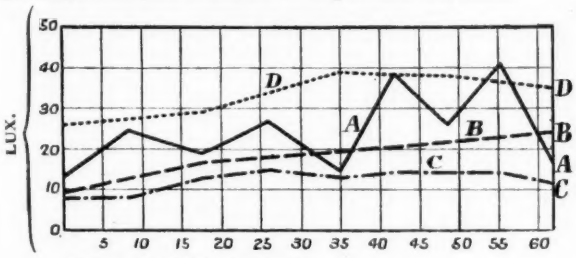


Fig. 5.—Illumination of a Vertical Surface.

The reading of the paper was followed by a short discussion, since supplemented by a written communication.

Herr Göhrum, the Manager of the Stuttgart Gas-Works, said for about five years great endeavours had been made to improve the lighting of the more important streets of Stuttgart. At first the Lucas light was tried; but in view of the advances made in electric lighting, it was decided to make trials of higher power gas-lamps. About eighteen months ago, half the Königstrasse was lighted with compressed air or high-pressure gas, while the other half was illuminated with electric arc lamps; and it was later decided to extend to other streets the gas lighting on the compressed-air system. In the speaker's opinion, high-pressure gas was more likely to give rise to explosions through leakage than the compressed-air system; while there would be greater difficulty in persuading the proprietors of shops and warehouses to put compressed-gas apparatus on their premises than compressed-air plant. Further, there was no need to measure the compressed air consumed; for by experience it would be known what was the cost of compressing the air corresponding to a given consumption of gas. The measurement of high-pressure gas, on the other hand, was attended with some difficulty, and in any case required special meters. The results obtained at Stuttgart with the compressed-air system had been quite satisfactory, though precise photometrical measurements had not been made.

Herr H. J. Trautmann, of Cologne, representing the James Keith and Blackman Company, of London, said that his firm had put on the market a new inverted high-pressure gas-lamp which had been exhibited for the first time at the International Exhibition at Edinburgh, and later at the Franco-British Exhibition in London. Photometric results had been published in detail in the "Journal of Gas Lighting;" but it had to be borne in mind that they were obtained with the richer London gas. Recently, however, these new gas-lamps had been tested in Germany at the Royal College at Charlottenburg, at the Technical College at Carlsruhe, and in the laboratory of the Berlin Gas-Works at Tegel; the results obtained being substantially the same. For instance, the Tegel results were as follows: At a pressure of 110 mm. of mercury (59 inches of water), a single-burner lamp gave a light in the horizontal plane of 1520 hefners (1382 candles) with a gas consumption of 745 litres (26·31 cubic feet) measured at ordinary pressure. The duty, therefore, was 0·49 litre per hefner (52½ candles per cubic foot). Careful measurements were also made at different angles over the lower hemisphere; and it was found that the mean lower hemispherical illuminating power was 92·4 per cent. of the horizontal, or that the duty was 0·531 litre per hefner (48½ candles per cubic foot) in respect of this lower hemispherical illumination. Hitherto the attempt had been made in high-pressure gas-lamps to avoid any great heat, and, in particular, heating of the mixture of primary air and gas. In the Keith lamp, on the other hand, the high efficiency was secured by constructing the lamp so that there was a special heating chamber in which the mixture of primary air and gas was raised to the highest possible temperature. There was no need to dilate upon the other various new features of the lamp. It might, however, be pointed out that the total weight of the lamp was very low. This was apparent when two of the lamps were being fixed at the time of the meeting in the Akazienstrasse, as one man was readily able to carry them up in one hand, and screw them on without difficulty at the top of the high standard. The lightness, however, was not secured at the expense of durability. Since the lamp was new, it was, of course, impossible to quote an experience extending over many years; but it might be mentioned that the Keith Company last year put up a number of lamps of similar structure and substance at the Dublin Exhibition, where they were exposed to the humid climate of Ireland, which was most injurious to such things. The lamps, however, consumed about double as much gas as the later pattern for the same illuminating power. The lamps at Dublin were in use every evening for seven months; and it was found when they were returned to the shops that they had not suffered in any way, but were as good as when new. It might therefore be assumed that the new pattern lamps, in which the consumption of gas was reduced by one-half, would also be durable. A double globe was used with the new Keith lamp, and had been found to be very advantageous in preventing breakages and minimizing the consequences of the same. The number of mantles used was also thereby kept at a minimum. For instance, the 230 lamps at the Franco-British Exhibition had required only five mantles to be renewed per diem.

Professor Drehschmidt, in replying to the discussion, said that lamps working on the compressed-air system, such as Herr Göhrum had used in Stuttgart, had been examined in the Berlin laboratory, and had been found to give a considerably lower duty than the high-pressure gas-lamps. It was, however, quite likely that the compressed-air system had since been improved; and he rejoiced to hear that as good results were obtained by it as with high-pressure gas.

In consequence of the recent death of Mr. W. Bailey, the Secretary and Manager of the Camborne Gas Company, the Directors have made the following appointments: Consulting Engineer, Mr. S. J. Ingram, of Truro; Secretary, Mr. W. J. Couch; Works Manager, Mr. C. C. Veale. Mr. Couch and Mr. Veale were respectively Accountant and Works Foreman prior to Mr. Bailey's death.

TAR FOR ROAD SURFACING.

An interesting paper, on the subject of the "Surface Treatment of Roads with reference to Dustlaying," was read by Mr. Reginald Brown, the Engineer and Surveyor to the Southall-Norwood Urban District Council, at the Congress of the Royal Sanitary Institution. This paper was noticed in the "JOURNAL" for July 28, under the heading of "The Utilization of Tar;" but a few remaining details may be of interest to readers.

The author speaks of the evil effects of road dust, and attributes much of the various throat and lung troubles to the inhalation of the mineral and inorganic dust arising from the wear of the material constituting our roadways. He is a firm believer in the use of oil-gas tar. He has, in fact, for the past two years, applied it to all the streets in his district, and has, in consequence, been able to entirely abandon the use of water-carts. Mr. Brown uses it in a cold state, and is well satisfied with the results. An ordinary watering cart is used to spray the tar, and manual labour to rub it into the surface. The appearance when finished is that of a newly-laid wood pavement; and the odour is of a similar nature. The material, being of almost the same density as water, sinks readily into the surface; and, from frequent tests, it has been found to penetrate to a distance of 2 inches. He also states that "the treatment tends to diminish the noise from traffic, and preserves the surface of the road from wear in a remarkable manner." Many roads, having to be renewed yearly under the old system of watering, only require renewing once in two years when oil tar is used. Mr. Brown adds that the same result would accrue from the use of coal tar.

To ensure that the treatment with oil-gas tar was free from objection from a hygienic point of view, it was decided that the Medical Officer of Health of Norwood should be invited to report on the question. The substance of his report (in 1906) was to the effect that the use of oil-gas tar was efficient in suppressing dust, and that if the roads throughout the district were so treated it would minimize the incidence of certain illnesses in the summer, and that a large part of the diarrhœal and sore throat illnesses during the summer is due to microbeal infection conveyed from dusty roads. He stated that "this substance is an antiseptic of the coal-tar series, and as such would destroy the living organisms in manure long before their disposal as dust could ensue."

The cost of surfacing with oil-gas tar is found to average 1d. per square yard for four dressings. Thus, a mile of roadway, 8 yards wide, will cost £58 13s. 4d. per watering season, which figure is identical with the cost of watering the same amount of road surface. So that the treatment of roadways with oil-gas tar is no more expensive than the corresponding cost of watering, though far more efficient.

Mr. Brown expresses the opinion that the use of both coal and oil tar will in many cases become general—using oil tar where it can be obtained and coal tar where oil tar is not made.

Some reports have appeared to the effect that the results of tar-painting have not been altogether satisfactory. That this is so is attributed by the author to the fact that the nature of the subsoil of the road has a very considerable bearing upon the result. Where the subsoil is clay or other impervious formation, the results have been unsatisfactory, while where a pervious subsoil exists, the result has been favourable.

That the use of tar for the treatment of roads compares on an equality in regard to cost with other preparations, is shown by the figures published by the author. Four preparations are mentioned, as follows:—

Akonia,	costing	£66	per mile of	road,	eight yards wide.
Calcium chloride,	,,	£66	,,	,,	,,
Halmide,	,,	£58 13s. 4d.	,,	,,	,,
Pulvicide,	,,	£61 11s. 8d.	,,	,,	,,
Tar,	,,	£58 13s. 4d.	,,	,,	,,

EFFECT OF ROAD-TARRING ON VEGETATION, ETC.

According to the Paris Correspondent of the "Daily Telegraph," the gardeners of the city have found out that, while tar on roads, lays the dust excellently, it steadily and rapidly kills vegetation. He says: "Trees lining tarred roads all die off in a short time. The latest experiment made has proved disastrous in the Avenue du Bois de Boulogne, leading to the wood from the Arch, which is crowded with motor cars as well as horse carriages in the season. The road was tarred four months ago, and the dust, which had been intolerable before, was successfully laid. But the fine particles of tar thrown up by passing vehicles have ruined vegetation. Seven of the finest trees along the avenue have been killed in the above space of time, and have had to be cut down. The flower-beds and grass-plots suffer even more; and the upkeep of the former is now ruinous for the city. It costs fully ten times more than the expense of watering the road as it was formerly, when merely macadamized. The discovery of the drawback of the tar surface is unfortunate. The City of Paris has decided to give up tar altogether for the avenues within its boundaries. The dust problem accordingly is now no nearer solution than before."

As the foregoing statement was freely copied by other papers, a representative of the "Evening Standard" had an interview on the subject with Mr. Rees Jeffreys, the Secretary of the Roads Improvement Association. He expressed the opinion that if distilled tar is used, as is done on the best English roads, no such danger as that referred to exists. "I pooh-pooh the whole idea," he said. "If the proper tar is used, and if it is put on the road in a proper manner, there can be no complaint. I am convinced that tar will enter into the question of road construction more and more. Tar undoubtedly is the best thing at present available." Replying to a further inquiry, Mr. Jeffreys said that he had heard occasionally of complaints against tar by people who asserted that it was injurious to eyesight. "But I am told," he added, "that there is no complaint when the proper distilled tar is used. When such complaints are made, they refer to the rough tar which has been used." Another objection made to the use of tar is that it kills fish in ponds adjacent to the road. This Mr. Jeffreys answered in the same way. "When you put the rough tar on the road," he added, "and, in addition, perhaps, put it on badly, it can easily be washed into watercourses, and it will then certainly kill fish."

ROAD-TARRING EXPERIMENTS IN AMERICA.

During the past few years, many preparations for the laying and preventing of dust on road surfaces have appeared on the market in competition with such materials as coal tar and petroleum; and it was therefore decided by the Office of Public Roads of the American Department of Agriculture to carry on a series of experiments during the summer of last year with the view of determining, if possible, their adaptability to different conditions. It was learned that the Highway Commission of Massachusetts intended to treat with a tar preparation a stretch of road leading into Boston; and arrangements were made by which the Office of Public Roads could carry on a number of experiments on sections of this road. The following particulars, taken from an official circular concerning the tests which has been issued by the Director of the Office (Mr. Logan W. Page), are reproduced from "Engineering Record."

The road selected for the experiments was a mixed trap and granite macadam in the townships of Weston and Wayland, which had been made about ten years previously, and had had but few repairs since that time. It is part of the main road connecting New York with Boston, and is about 16 miles from the centre of the latter city. The automobile traffic is consequently heavy; and this, in addition to teaming and other traffic, has produced serious results; the macadam in some cases being completely broken through. There were many rut holes, some of them 30 feet long and averaging from 1 to 3 feet in width; and a large number of smaller holes more nearly circular in shape. Every rapidly-moving automobile which passed would, in dry weather, raise a cloud of dust, which would be blown over the surrounding country, causing considerable annoyance to neighbouring dwellers as well as damage to the road. Sections of this road as nearly alike as possible were selected for the experiments, which were made with water-gas tar, crude coal tar, various mixtures of the two applied in different ways, and a special coal-tar product.

The water-gas tar—a thin, oily liquid—was procured from a local gas company at $1·50 per barrel of 50 gallons delivered. The crude coal tar was also obtained from a local gas company in 50-gallon barrels at $2 per barrel delivered at Wayland. It had been produced at a comparatively low temperature, and contained a good pitch base. The special coal-tar product was supplied free of charge by the manufacturing company in 50-gallon barrels. It did not contain any water, was free from the extremely volatile oils present in the crude tar, and held a good pitch base. Its other properties are shown, in comparison with the water-gas and coal tars, in the following table:—

Kind of Tar.	Specific Gravity.	Ammoniacal Liquor.	Total Light Oils to 170° C.	Total Dead Oils, 170° to 270° C.	Residue, per Cent. (by difference).
Water-gas tar	1·041	2·4	21·6	52·0	24·0
Coal tar	1·210	2·0	17·2	26·0	54·8
Special tar preparation	1·177	—	12·8	47·6	39·6

Labour was furnished to the Highway Commission under contract; the Contractor receiving a stated salary per day and a bonus of 15 per cent. of the actual cost of the labour supplied. The cost per eight-hour day was as follows: Common labour, $1·50 to $1·85; single teams, $3; double teams, $5; foreman, $3; steam-roller, $12. Two steam-rollers were employed; and as one belonged to the Highway Commission, the daily cost of running it included only the hire of the engineer at $2·50 per day and the cost of the fuel. A 12-barrel heating-kettle, with a portable fire-box and mounted on wheels, stiff street-sweeping brooms, picks, shovels, &c., a 2-horse sweeper, and a tank-waggon for the water-gas tar, constituted the outfit necessary to carry on the work. As the road was in bad condition, it was found necessary to make extensive repairs before applying the tar. The cost of these per square yard of road surface was from 2·6 c. to 3·3 c.

The tar was applied during the month of August and only in dry, warm weather. Before the road was entirely completed, it was found necessary to remove all the dust and waste material which had accumulated and been swept into the gutters. This

had to be carted away and dumped in convenient places near the road. It added from 1 c. to 1·3 c. per square yard to the total cost of treatment. In estimating the cost per square yard of the different sections, these figures are included in proportion to the length of section treated. In all, thirteen different experiments were made—four with water-gas tar alone, three with coal tar, three with mixtures of water-gas tar and coal tar, and three with special tar preparations. The following is a brief description of each, with a statement of the cost and the results obtained after three months' trial.

(1) *Water-Gas Tar.*—A section of road having numerous ruts and holes was first thoroughly swept and repairs made where required. It was found necessary to have the sweeping done first, in order to prevent the sweeper from tearing up the loose stones in the patches. The unheated water-gas tar was then spread upon the road from the tank-waggon, and well broomed in. It was readily absorbed by the road surface, and failed to hold a light coat of gravel which was spread and rolled down. Another application of tar was made, and sufficient gravel added to completely absorb the excess tar. The surface was then well rolled; but it refused to compact properly, and showed a strong tendency to pick-up under the roller where the road was patched. Indications pointed strongly towards a failure; but after the road was subjected to traffic for a few days, it was noticed that its appearance was somewhat improved, though the patches showed signs of ravelling. In damp weather the road showed up to advantage, and no disagreeable mud was noticed, even after heavy rains. In dry weather, the dust was well laid; and, though the top was not firmly compacted, it seemed to remain in place under the action of traffic. When inspected three months later, the road was in a much better condition. The loose surface had packed down well, and the patches were holding much better than was to be expected from earlier observations. The road at that time was practically free from dust, and presented a fairly good appearance. The section thus treated was 1275 feet in length. The tar was applied for a width of 12 feet, and with an average of 0·9 gallon of tar per square yard. If the road had contained fewer holes, and been less in need of a heavy top dressing, a much smaller quantity of tar could undoubtedly have been made to give the same results. The cost of application was 4·9 c. per square yard for labour, 2·7 c. for tar, and 0·8 c. for gravel. This added to the cost of repairs, 3·2 c., and of removing refuse material, 1·3 c., makes a total of 12·9 c. per square yard. The entire area covered was 1700 square yards.

(2) *Water-Gas Tar.*—The section of road treated in this experiment was in about the same condition as the preceding one. The cost of repairs was practically the same per square yard; but there were not so many large holes to be patched. The tar and gravel were applied in the same manner to the roads, which had been well swept and repaired; but in this case only one treatment of each was given. The surface was well rolled; but, as in the preceding case, it did not compact well, though no tendency to pick-up under the roller was observed. The surface improved under traffic, and held well in rainy weather. No dust was formed; and after one week but little difference could be detected between the two sections. The colour of this section, however, was somewhat lighter than No. 1. At the end of three months it compared very favourably with it, although the surface was not quite so well compacted. It was practically dustless. This section was 125 feet in length, and application was made over a width of 12 feet. There was used on each square yard treated 0·38 gallon of tar. The cost of application was 4·9 c. per square yard for labour, 1·1 c. for tar, and 0·8 c. for gravel. Repairs cost 3·3 c., and removing waste material 1·3 c.—a total of 11·4 c. per square yard. The area treated was 167 square yards.

(3) *Water-Gas Tar.*—For the purpose of determining the value of water-gas tar as a dust layer, without reference to its value as a surface binder, a section of road which was in excellent condition was sprinkled with this material. An ordinary sprinkling-cart was used, and no attempt was made to clean the road surface before treatment. As much tar was applied as the road would absorb without becoming too muddy. No dressing of screenings or gravel was applied. When dry, the road showed a much darker colour, the dust was well laid, and no formation of dust was noticed for two weeks after treatment. At the end of three months, very little dust was raised by a rapidly moving automobile, and the road surface seemed considerably hardened by the residual matter retained after the more volatile products of the tar had evaporated. A length of 300 feet of roadway was treated in this manner for a width of 15 feet, and 0·3 gallon of tar applied per square yard. For the short section treated, the cost of labour amounted to 0·6 c. and the material to 0·9 c. per square yard—a total of 1·5 c. For long stretches of road, however, the cost could undoubtedly be cut down to slightly more than 1 c. per square yard.

(4) *Water-Gas Tar.*—For this experiment a short section of road in good condition was selected, in order to make a direct comparison with No. 3. In this case the road was first carefully swept, and the tar allowed to run upon it from barrels; being afterwards thoroughly broomed in. In this case the road would absorb only 0·25 gallon of tar per square yard. It presented much the same appearance as in experiment No. 3; but, owing to the removal of all the dust and fine material, it was rougher, and therefore less satisfactory. No dust formed, even at the end of three months, but the road at the time lacked the thin cushion of fine material that was held by No. 3. From these two experiments, it is evident the presence of dust and other fine material on the road is rather beneficial than otherwise when water-gas tar is applied. A section of roadway 150 feet long and 12 feet wide was treated in this way. The cost of application amounted to 1·3 c. per square yard for labour and 0·8 c. for materials, while the cost of removing waste material from the gutters was 1·2 c.—a total of 3·3 c. An area of 200 square yards was treated.

(5) *Coal Tar.*—The section selected for this experiment was in about the same condition as that for experiment No. 1. The coal tar was first heated to a temperature of 180° Fahr. in the kettle, and then run upon the road from a hose connected to a draw-off at one end. A coat of gravel was spread over the road soon after the tar had been applied, and rolled down to a smooth, even surface during the same day. After one week's service but little dust was raised by passing automobiles; and at the end of three months the road was dustless, and presented much the same appearance as asphalt, although the large patches were a little rough. The road seemed to shed water well, and dried quickly after a rain. The section thus treated was 150 feet in length, and 15 feet wide; and 0·6 gallon of tar was applied per square yard. The cost of application was 6·1 c. per square yard for labour, 2·4 c. for tar, 0·8 c. for gravel, 2·6 c. for repairs, and 1 c. for removing waste material—making a total of 12·9 c. An area of 250 square yards was treated.

(6) *Coal Tar.*—This experiment was made in the same manner as No. 5, and on a section of road similar in every respect. A small quantity of the cold tar was first tried, but was not absorbed by the road, and could not be broomed to any advantage. It was found necessary to heat the tar to a temperature of 145° Fahr. before it could be used satisfactorily; but when applied at this temperature it gave results in every way as good as No. 5, though slightly more tar was required per square yard than in that experiment. In this case, as in the other, the patches were not entirely satisfactory. A somewhat longer stretch of road was treated in this experiment, and, though slightly more tar was used, the cost of application per square yard remained the same, as the labour item was lowered. The section was 600 feet in length and 15 feet in width; and 0·7 gallon was applied per square yard. For this application labour cost 5·6 c., tar 2·8 c., and gravel 0·9 c.; while repairs cost 26 c., and removing waste material 1 c. —making a total of 12·9 c. An area of 1000 square yards was treated.

(7) *Coal Tar.*—In order to get the best results possible with coal tar, a section of road free from holes was selected. The road had been badly worn, and the surface was somewhat rough; but it was in a condition good enough to provide a fair test. No preliminary repairs were made; but the road was well swept, as in the case of the other two experiments with coal tar, and the tar applied and broomed-in in the same way at a temperature of 195° Fahr. A heavy coat of gravel was then applied and well rolled and compacted, in order to produce a smooth surface when completed. For some time afterwards the road was slightly dusty; but at the end of three months it presented a better appearance than the other two sections, though not quite so much like asphalt. At that time it was practically dustless. This section was 450 feet in length, and was covered for a width of 12 feet. Only 0·42 gallon of tar was applied per square yard. The cost of application was, for labour 4·4 c. per square yard, tar 1·7 c., gravel 1·4 c., and removing waste material 1·3 c.—making a total of 8·8 c. An area of 600 square yards was treated.

(8) *Water-Gas Tar and Coal Tar.*—A section of road containing many ruts and holes had been treated with water-gas tar in the same manner as in experiment No. 2, in which section it was first intended to be included. As gravel could not be applied the same day, however, and as the surface the next day was too dry to hold down a top dressing, it was decided to finish the work by applying coal tar before spreading the gravel. It was put on in the same manner as in No. 5, as was also a top coating of gravel which was afterwards well rolled. This section was inspected three months afterwards, and it is very doubtful if the presence of the water-gas tar was of any advantage. The section treated was 250 feet long and 15 feet wide; and 0·3 gallon of water-gas tar and 0·6 gallon of coal tar were applied per square yard. The cost of application was for labour 5·8 c. per square yard, tar 3·3 c., gravel 1 c., for repairs 2·6 c., and removing waste material 1 c.—a total of 13·7 c. An area of 417 square yards was treated.

(9) *Water-Gas Tar and Coal Tar.*—Since it was found that coal tar could not be applied satisfactorily when cold, it was thought that a mixture of coal tar and water-gas tar might be made which could be used without the trouble and expense of heating, and which at the same time would hold down a surface dressing better than water-gas tar alone, because of its greater body. A section of road, rough but free from holes, was selected for this experiment. After having been carefully swept, it was treated with a mixture of equal parts of water-gas tar and coal tar. This material was applied cold from the kettle in which it was made, and a light covering of clean ½-inch trap screenings or pea stone spread on top. The mixture was not heavy enough to hold down as much dressing as should have been applied to bring the top to a perfectly smooth condition; but when the road was well rolled a surface was formed which was fairly smooth, and offered a good foothold for horses without increasing the resistance to traction of vehicles. The road was absolutely dustless when inspected three months later, and had worn somewhat smoother. A section

of roadway 560 feet long and 15 feet wide was treated with this mixture, and 0·43 gallon applied per square yard. The cost of application was for labour 3 c. per square yard, tar 1·5 c., screenings 0·7 c., and removing waste material 1 c.—a total of 6·2 c. An area of 933 square yards was treated.

(10) *Water-Gas Tar and Coal Tar.*—A slightly heavier mixture was applied in this experiment on the same kind of road and in the same manner as in No. 9, with the exception that gravel was used instead of pea stone for a top dressing. Five parts of coal tar were used to three parts of water-gas tar, and 0·48 gallon was applied per square yard. The mixture, however, did not hold down the gravel well. As a result, the road was slightly dusty for some time, and though in better condition at the end of three months, did not present so good an appearance as No. 9 and the surface seemed to be rather porous. A section of road 1000 feet long and 15 feet wide was treated in this manner, and the cost of application was for labour 3·7 c., tar 1·7 c., surface material 0·8 c., and removing waste material 1 c.—a total of 7·2 c. The area covered was 1667 square yards.

(11) *Special Tar Mixture.*—A section of road, rough but free from holes, including a rather sharp curve, was selected for this experiment. After being thoroughly swept, it was treated with a mixture of water-gas tar, coal tar, rosin, and other substances, applied at a temperature of 200° Fahr. from a kettle, in the same manner as in No. 5. A rather heavy dressing of pea stone was then applied and rolled once or twice. A good asphalt-like surface was formed, which was free from dust, and which at the end of three months presented a very favourable appearance in comparison with the other experiments. The surface was hard and resilient without offering the resistance to traction noticed on many of the other sections. About 200 feet of road 12 feet wide was treated and 0 42 gallon applied per square yard. The cost of application was, for labour, 4·6 c., tar mixture 2·6 c., pea stone 1·7 c., and removal of waste material 1·3 c.—a total of 10·2 c. An area of 267 square yards was treated.

(12) *Special Tar Preparation.*—A short section of road in such bad shape that resurfacing was necessary was selected for this experiment. The road was therefore first torn up with a steam-roller fitted with spikes. A course of No. 2 stone was then spread on and rolled, and followed by a course of pea stone, which was also thoroughly rolled. As the kettle could not be dragged across this road without tearing it up, the material, at a temperature of 218° Fahr., was applied by means of coal hods, and no attempt was made to broom it in. A large amount of the tar preparation was absorbed by the road, and only a light course of pea stone was placed on top. The whole was then rolled for a short time and well consolidated. The road thus formed presented a fine appearance, and was absolutely dustless. At the end of three months, the appearance was still good; but a few rough and porous places existed, where the tar had gone through the surface and into the foundation. It was absolutely dustless, however. The treatment proved to be expensive. A portion of road 75 feet long and 12 feet wide was treated in this manner, and 1·5 gallons of the tar preparation applied per square yard. The cost of application was 14·8 c. for labour, 9 c. for material (reckoned at 6 c. per gallon), 3·3 c. for screenings, 3·3 c. for repairs (not including the pea stone), and 1·2 c. for removing waste material—a total of 31·6 c. per square yard. The area was 100 square yards.

(13) *Special Tar Preparation.*—A section of road free from holes, but somewhat rough, was selected for this experiment. Material similar to that used in No. 12 was heated to 185° Fahr., and applied to the road in the same manner as in No. 5. The road had first been swept. A heavy covering of pea stone was then applied and rolled down. The surface formed was smooth and dustless, asphalt-like in appearance, and apparently waterproof. In very hot weather it was somewhat sticky in places; but this was doubtless due to the fact that more tar was used than was absolutely necessary. After three months, it presented a smooth and even appearance and was dustless. A section of road 490 feet long and 15 feet wide was treated, and 0·67 gallon of the mixture was applied per square yard. The cost of application amounted to 5·8 c. for labour, 4 c. for the tar mixture, 1·9 c. for pea stone, and 1 c. for removing waste material—a total of 12·7 c. per square yard. A total area of 817 square yards was treated.

Summary of Experiments with Tar Products.—In considering the tar experiments, it will be noticed that in almost every case the cost for labour per square yard is high. This was largely due to the shortness of the sections treated, which made it impossible to handle large quantities of material at one time, and prevented systematic routine work on the part of the labourers. Adding to this the cost of extensive repairs, and of removing large quantities of waste material which had collected in the gutters, the total cost per square yard is in most cases considerably in excess of what similar work could be done for under ordinary conditions. Nearly all the sections were in good condition when they were inspected last November.

Some facts of interest have been noted, which it may be well to mention at this point. It has been shown that water-gas tar is a satisfactory dust layer and preventive when used in moderate quantities on roads already in fairly good condition. It can undoubtedly be applied to the best advantage by means of an ordinary sprinkling-cart on the unprepared road; and when used in this way it serves to make the road surface firm, and keep down the dust for some time at a very reasonable cost. Its odour is objectionable at first, but soon passes off. It must necessarily be applied more frequently than heavier tars, owing to its lack of body. Where extensive repairs have to be made before treatment, it has but little value as a binder for the large loose material; and whether its use, even in large quantities, will be satisfactory for this purpose, and for holding down a heavy top dressing, is a matter for the future to decide.

In conclusion, it is pointed out that the surface treatment of roads with tar is more a palliative than a preventive of the dust nuisance; and it is considered that some more permanent method of dealing with roads is essential for lasting results. It is stated to be the intention of the Office of Public Roads to carry out experiments on these lines in the near future, using a well-tarred sand to supply a part of the binding material and fill the voids.

CEMENT JOINTS FOR GAS-MAINS.

On the occasion of the last annual meeting of the Natural Gas Association of America, a paper on the subject of the installation of the distributing plant for natural gas was read by Mr. J. B. Klumpp, the Inspection Engineer of the United Gas Improvement Company of Philadelphia. As an appendix to his paper, the author gave the following directions for the use of cement in making joints for ordinary spigot and socket iron mains.

Use portland cement; natural cements are not uniform in quality, and, as a rule, are too quick setting to permit of their use with safety. In selecting the brand, take a relatively quick-setting cement. If it sets too slowly, there is danger of the finished joint being disturbed before setting. Use the cement neat (no sand) and as dry as practicable, so that hammering the yarn against it is required in order to bring the moisture to the surface. When sufficient water is added, the cement will still appear crumbly in the pan, and will just retain the impression of the fingers when squeezed in the hand. It should be mixed in the shade, and all lumps and foreign matter should be carefully excluded. The cement should be used immediately after mixing. If it lies unused for more than five minutes, it should be discarded. The cement remaining in the pan should be entirely removed by hammering on the bottom before mixing up any new cement. In mixing cement, first determine the amount required for one joint, and the quantity of water required for the cement; then always use the cement and water by measurement.

Use jute yarn, untarred. When the joint is made, the yarn and sides of the joint may be moist or damp, but should not be wet. Great care should be taken to have the surface of the bell and spigot constituting the joint as clean as possible. If there is any appreciable rust, it should be scraped off with a wire brush; and, if necessary, gasoline should be applied to cut out the rust still further—this being done at least a day before the joint is to be made, in order to give the gasoline time to evaporate. The finished joint should consist of one roll of yarn just long enough to reach once round the pipe, twisted and driven tightly to the bottom of the bell; then a solid mass of cement extending to a point about 1½ inches at the back of the face of the bell; then a second roll of yarn; then a facing of cement. Do not make a large fillet extending to the outside diameter of the bell.

In making the joint, after the first yarn has been driven in tightly, the cement may be pushed in with the hands, using rubber gloves or mitts (preferably the latter), until the whole space is filled as tightly as it is possible to do so with the hands; care being taken to fill the space completely. A wooden tool is useful for pushing back the cement after it has been put in with the hands. Sometimes a roll of yarn is used to drive the cement back; the yarn being withdrawn, more cement inserted, and the process repeated. The second roll of yarn is then put in, and driven back by means of a tool similar to a yarning-tool, but with a blunter edge, until it is driven home. The remaining space is then filled with cement. The hard driving of the second yarn is very important, being necessary to so compact the first cement that there will be no chance for gas to get either through it or between it and the iron; and it should be driven far enough back to allow the final cement to key into place. After the first yarn is in, and before the first cement is inserted, the pipe should be thoroughly bedded and tamped-in between the bell holes to a depth of at least a foot, to prevent any movement of the pipe disturbing the joint after it is made.

The pipe must be kept cool, and at as nearly as possible a uniform temperature, from the time preceding the making of the joint until after it is firmly covered. As few joints as possible should be made in the rain. If work is done on a hot day, and the pipe has been exposed to the sun, so that it has become quite heated, it is advisable to cool it off by the application of water to the inside of the bell and the outside of the spigot—care being exercised not to have any water left in the bottom of the joint, the effect of which would be to make the cement too wet.

All joints should be tested before being covered up. The best test is made by connecting gas pressure to the new pipe through a meter—thus measuring any leakage. If the meter indicates leakage, the holes should be found by putting soapsuds on the joints. Fire should never be used. The joints should be tested only after the cement has been set sufficiently to prevent its being injured by the soapsuds. Where feasible, this should be done

the following day. Cement joints should never be laid in filled or swampy ground.

The following are special directions for making cement joints in laying 16-inch and larger mains: Each pipe should be laid on four blocks, two at the back of the bell, called the "bell blocks," and two in front of the bell of the preceding pipe, called the "spigot blocks." All blocks must have a full bearing on solid ground, and be firmly bedded with a heavy paving-hammer. If the ground is soft, extra care must be taken to prevent settling. Larger blocks can be used, and special precautions taken to make sure that they have a solid, even bearing on the ground beneath them. For 24-inch and larger mains, there should be a block bearing surface of at least 10 square feet beneath each pipe; and under 24-inch mains, 8 square feet. The best size of block is 3 in. by 12 in. by 24 in. for 16-inch and 20-inch mains, and 4 in. by 12 in. by 30 in. for larger ones. The bell blocks should be set as nearly as possible on the grade of the bottom of the pipe; the spigot blocks 1 inch below this grade, so as to allow for the use of wedges to centre the spigot end.

After setting the pipe, the joint should be spaced by weight off the joint. The best size of wedge is 5 inches wide, 12 inches long, and 3 inches thick at one end, tapering towards the other. As soon as the joint is spaced, yarn should be put lightly in the face of the joint to keep out all dirt until the joint is made. Tamp the dirt round the sides of the pipe, and cover it to a depth of at least 12 inches, except at the bell holes, and allow the pipe to stand at least 12 hours before making-up the joints. While tamping, keep the joint spaced by iron wedges driven lightly in the joint, but remove these as soon as the tamping is completed. It is a good plan to make-up the joints early in the morning, protect them during the day, test them the following morning, and immediately fill in.

On the large mains, the first yarn, twisted into a rope about the same diameter as the width of the joints, should be thoroughly saturated with neat cement mixed with water to the consistency of cream. This yarn should be driven solidly against the back of the bell, using heavy yarning-irons and a hammer. The second yarn should not be thus prepared, but should be used dry. Cement may be pushed into the joint with a hard wood or steel tool, not more than 2½ inches wide, or a trowel. A joint once started should be filled and yarned without delay.

PRODUCER v. COAL GAS FOR POWER.

In the course of the proceedings at the First Annual Meeting of the Canadian Gas Association, Mr. E. J. Philip, of Berlin (Ont.), read a short paper on the use of producer gas for power purposes, in which he showed that this gas need not be a strong competitor with ordinary illuminating gas.

Having described the method of making producer gas, the author said it was an economical source of power, especially in engines from 40 H.P. upwards. Its disadvantages were its varying quality, its large volume in relation to its power, and its very poisonous nature. The first disadvantage entailed extra attention at the engine as compared with ordinary illuminating or natural gas; the second necessitated a larger engine to do the same work; and the last made it unpleasant to work with, and also increased the liability to accident. Mr. Philip went on to explain that, in the earlier types of producer, the gas was made under pressure—a steam-jet blower being used to produce the blast; and this was the general type of the large plants. In 1895, a Frenchman named Benier made an engine draw its own supply of gas from a Dowson producer, without the aid of a blower or the intervention of a holder. This was the first type of suction gas-producer that operated an engine. It had many faults, but the idea was good; and the present type of suction producer is similar in many ways. This type is employed almost exclusively for small units, and is used successfully in sizes up to 250 H.P.; but above this size, or where there are a number of engines to operate from one producer, the present type is better. Coming to the interesting point for ordinary gas companies—viz., the competition they can experience from producer gas—Mr. Philip said: In any reasonable gas-works which have not got beyond their capacity, each extra 1000 cubic feet made with the same plant costs very little. If a customer who, we will say, for the sake of argument, is using a gas-engine, talks of putting in producer-gas plant, he has first to procure additional apparatus. It will take extra labour to operate it, even if it is small. He has the trouble of getting in coal and getting out ashes; he has an extra fire risk; he has an extra explosion risk and extra accident liability—all points that cost money, or are at any time liable to cost something. With the gas-engine working on illuminating gas, he has small capital outlay; his fuel supply is always ready (no waiting in the morning to clean the producer or get the gas of proper quality); and the quality is always right if he gets it from the gas company. When he shuts down at night, there is no fire in connection with the plant; the gas is so uniform that you can always start on time. If you are forced to start up for any reason, your fuel supply is always ready and waiting. The point of difference comes in when you get to economy. The producer will make cheap power; but even if it does, let the gas companies make a special rate for gas-engines, and with a low rate for gas, and the other troubles and expense eliminated, the average manufacturer will be better off to operate illuminating gas up to 40 H.P.

RESEARCH WORK OF THE WATER BOARD.

Dr. Houston on the Effect of Storage.

Just before the rising of the Metropolitan Water Board for the summer recess, the members had before them the first report by the Director of Water Examinations (Dr. A. C. Houston) on the research work carried out in his department. It is an elaborate document, containing the tabulated results of a large number of experiments; but, for the average water-works engineer, Dr. Houston's remarks on the "safety change" which takes place in river water as the result of storage, and the conclusions he arrives at, will be of most practical value. These we reproduce in their entirety. In connection with the first subject, he directs special attention to the pioneer work of Professor Percy Frankland in 1892, which he says must be borne in mind in any report dealing with the beneficial effects of storage on river water.

Effect of Storage on River Water.

Is it possible to judge by comparatively simple tests whether raw river water has been stored for a length of time sufficient to ensure the destruction of all (or nearly all) typhoid bacilli if these happened to be present originally in the water? In short, is it possible so to correlate simple and specific tests, that tests of a purely simple character may be used to afford definite, though indirect, evidence that the water reaching the filter-beds is in a reasonably "safe" condition? This subject is still being worked at, and will be reported upon in due course; but there is no doubt that it is possible, by certain comparatively easy tests, to show that, under storage, a "change" has occurred in river water which, in all probability, could only have resulted from sustained storage, and that this "change" is associated with relative—perhaps even absolute—"safety" of the water so far as the typhoid fever bacillus is concerned.

There are more ways than one for arriving at this knowledge; but one way may be given as an example. The raw Thames and Lea river water uniformly contains excremental bacteria; and usually these are present in considerable abundance. A certain number of days' storage is required to ensure the disappearance of these undesirable microbes from a certain volume of water. The same number of days suffices also for the elimination, practically speaking, of typhoid bacilli from the same water, when these micro-organisms have been artificially added to it.

The importance of some simple and sure test in the above connection is obvious. The Water Board have over 160 filter-beds, the greater number of which are in constant operation. Despite the very large number of samples examined from day to day at the Board's laboratories, there is constantly passing into the public supply water of which the quality has not been bacteriologically determined. If it can be shown that the general body of water reaching the filter-beds exhibits the "change" I have referred to, and consequently is already in a "safe" condition, a great administrative advance will have been made.

Happily it is not essential to examine a great number of samples for the purpose of ascertaining whether, as regards a given section of stored water, the change has occurred and is enduring. For although river water may vary in character from day to day, or even from hour to hour, large storage reservoirs have such a remarkable "levelling" effect that the water leaving such reservoirs exhibits no similar or parallel sudden fluctuations in quality. Thus it happens that from the examination of even occasional samples of stored water a trustworthy judgment may be formed as to the uniformly "safe" quality of the water reaching the filter-beds.*

In a word, it is not impossible that the "safety" of an adequately stored water may come to be accepted so fully as even to afford justification for filtration through mechanical filters at a specially rapid rate, with the result of thus compensating to a large extent for the initial cost of the storage reservoirs. Doubtless there is much to be said for a policy of preserving all the old filtration safeguards, and adding to them the enormous benefits accruing from adequate storage. Nevertheless, I myself am satisfied a well-stored rapidly filtered water is likely to be safer than an unstored slowly filtered water.

Conclusions.

The Water Board's existing storage reservoirs (excluding the Hampstead, Highgate, and Camden Park ponds) are capable of holding, in the aggregate, 8883·7 million gallons—*i.e.*, forty times the 219 million gallons which constitute the daily average supply. Parliamentary powers have been obtained for the construction of storage reservoirs capable of holding an additional 6000 million gallons; and part of the work to this end is now in course of construction. At present, however, the provision of storage accommodation at the various works is most unequal.

This is a legacy from the days of the old Water Companies, and is related to a time when each Company naturally looked to its own particular necessities. Then it was generally believed that if the raw river water looked bright and clear, it was the best and safest water to use for filtration purposes, and that the use of stored water ought to be confined to periods when the river was turbid and discoloured. The East London Company were a

* It should, however, be noted that the tests used for this purpose are not infallible, and they may be at fault when dealing with mixtures of stored and unstored water in certain proportions.—A.C.H.

notable exception in this matter, though, of course, the circumstances of the Company were peculiar; and their provision of huge storage reservoirs was an absolute necessity to avoid the possibility of a water famine. But from the point of view of the Water Board, and on the assumption that a "pooling" of stored water is practicable, the absence (or deficiency) of storage in some cases, and the existence of an excess, relatively speaking, of storage accommodation in others, cannot be considered satisfactory.

Meanwhile, the policy of linking together the filtered-water mains of the different districts has undoubtedly paved the way for dealing with the question of storage in a large and general way. If only a "pooling" of stored water interests be feasible, and provided also enough water of reasonably good quality were abstractable daily from the Rivers Thames and Lea, the total amount of storage accommodation at present existing might seem to be far from unsatisfactory. But unfortunately these rivers may be in high flood, and therefore not in a fit state for abstraction during a certain period of the year, or very low at dry seasons, and therefore deficient in their amount of yield; so that whatever storage is required for new reasons of safety should, strictly speaking, be in excess of the amount required to meet the circumstances pertaining to these two cases of flood and drought.

Nevertheless, during a great part of the year there is plenty of reasonably good, relatively speaking, river water available for storage at only the cost of pumping; and nothing stands in the way of supplying all the filters with adequately stored water except the existing unsatisfactory regulations governing the abstraction of river water, and the unequal provision of storage accommodation at different works. It will not be disputed that the results set forth in this report go strongly to indicate that the security against dangerous intestinal bacteria to be gained even by a few days' storage may be so material an advantage that the use of raw unstored river water for filtration purposes should be greatly deprecated.

As regards the debatable question of the minimum number of days that water should be stored before being filtered, it might be urged, as a "counsel of perfection," that inasmuch as in the majority of the experiments a few of the typhoid bacilli survived from five to eight weeks, at least one to two months' storage is necessary to secure complete safety. Indeed, apart from the question of possible deterioration of the water due to an excessive development of vegetable growths, over-storage is believed to be impossible. On the other hand, before coming to even a tentative decision in this matter, attention must needs be directed to the following facts.

In the first place, there is the serious expense involved in constructing huge storage reservoirs; and in this connection it should be borne in mind that a point may be reached beyond which the extra expenditure on storage would seem, to an increasing extent, not to be balanced by a commensurate gain in freedom from risk of danger to health.

Secondly, there is the inevitable danger that prolonged storage, especially if the water remains stagnant, may lead to the abnormal development of vegetable growths—materials harmless in themselves, but resulting in deterioration of the water, as judged by chemical and physical standards, and attended by practical difficulties in connection with its filtration. I dealt with this matter in my annual report for the year ended March 31, 1907, and am quite unable to forecast the future, or to offer any assurance that trouble will not arise annually or occasionally from this cause. On the other hand, it is well worth noting that the water of the River Lea, after storage in the Walthamstow reservoirs for a nominal period of 57 days, is very pure bacteriologically, and remarkably free from algæ growths. So it must not be concluded that storage, even for a long time, habitually or necessarily creates conditions inimical to filtration.

Thirdly, there is the point to be considered that, though the Rivers Thames and Lea and the New River are all undoubtedly impure sources of supply as judged by the number of excremental bacteria present in them, they may nevertheless be relatively free from the microbes capable of causing specific diseases—*e.g.*, typhoid fever. Indeed, the results of certain experiments which have been in progress for the best part of a year tend to show that the Rivers Thames and Lea, though seriously polluted with sewage, are safer epidemiologically than could have been supposed in the absence of this new and distinctive knowledge. Nevertheless, these experiments are not yet completed; and even when completed the results must bear the brunt of scientific criticism before being accepted, even in a partial sense, as being altogether valid.

Fourthly, there is the incontestable fact that there is no convincing evidence that the incidence of diseases liable to be water-borne has been, or is now, appreciably greater in the case of Water London than in that of other large communities deriving their water supply from unpolluted sources. Nevertheless, in connection with this argument, it is necessary to bear in mind certain circumstances which are of real importance. For example, a severe epidemic of typhoid fever occurring in any of the large towns bordering the Rivers Thames and Lea above, and not far distant from, the Board's intakes, might, in the absence of adequate storage and a perfect system of filtration, have far-reaching and unfortunate results. It needs to be remembered that there have been actual cases where the health statistics of a town remained for long of a reassuring character until the advent of an epidemic destroyed their apparent significance in relation to a long term of years. A concrete instance may be given. The total number of deaths from typhoid fever in Lincoln for eighteen years (1887-1904) was 119. The short period of less than six months from Nov. 27, 1904, to May 6, 1905, sufficed actually to double this number. In other words, an epidemic in less than six months caused as many deaths as had occurred, from a similar cause, during eighteen years.

Fifthly, there is the circumstance that the experiments described in this report were carried out under artificial laboratory conditions of experiment. The American experiments were carried out by well-known bacteriologists, outside the laboratory and under conditions apparently more closely resembling those that naturally occur than any previously recorded. In nearly all the experiments, the death of the typhoid bacillus was a matter of days rather than of weeks. Nevertheless, it is difficult to escape the apprehension that if it is possible to isolate the typhoid bacillus from water in the laboratory one to two months after purposely infecting it (however gross the infection may have been), there is danger in assuming that under natural conditions its vitality would necessarily be lost within a few days.

Within certain limits, the matter needs to be looked at rather from the point of view of how long the typhoid bacillus can remain alive in water under conditions favourable to its vitality, than from the other aspect—viz., how short a period it can survive under conditions unfavourable to its existence. Extra long storage may provide too wide a margin of safety; but very short storage is only justifiable on the assumption that our knowledge is really complete.

Having considered some of the chief reasons against over-storage, it is necessary to revert to the difficult question of the minimum number of days that water should be stored before being filtered. On scientific grounds, it is essential to note that a demand might arise for storage of water for two months, because in two out of the eighteen experiments a few typhoid bacilli were alive eight weeks after infection of the water. Nevertheless, no serious exception should be taken to a proposition that, for all practical purposes, the limit may reasonably be placed at four weeks.

In the following eight paragraphs, endeavour has been made to crystallize the chief conclusions at which I am arriving.

(*a*) It is most desirable that the question of storage should be looked at from a general standpoint, so as to render the length of time during which water is stored more uniform throughout the different districts. Hence the policy of intercommunication already being applied to the filtered water should be extended to the stored water, as far as this is practicable.

(*b*) The advantages accruing from even a few days' storage may be so material that—exceptional cases apart—the use of raw unstored river water for filtration purposes should be strongly deprecated.

(*c*) Although as a "counsel of perfection" a water should possibly be stored for one to two months, storage for four weeks may perhaps, in the present state of our knowledge, be regarded as affording a sufficient margin of safety.

(*d*) It is possible to determine, with reasonable accuracy, whether the water being used for filtration purposes has been stored antecedently for such a length of time as to give relative, if not absolute, assurance that any harmful properties it may originally have possessed have been destroyed in the process of storage.

(*e*) It is not impossible that the additional "safety" conferred by adequate storage may come to be regarded as a reasonable pretext for filtration through mechanical filters at specially rapid rates, thereby effecting considerable economies in the cost of filtration as ordinarily practised. But any departure from old-established filtration custom should not be entertained, in the absence of convincing experimental proof as to the reliability of the new process.

(*f*) The question of storage is one both of quality and quantity; and, strictly speaking, the number of days it is desirable to store water to improve its quality should be added to the minimum number of days of storage which it is necessary to provide in guarding against the possibility of a shortage of water. Nevertheless, during a considerable part of each year, there is an abundance of water of relatively good quality in the Thames and Lea; and the existing storage reservoirs are sufficiently large, in the aggregate, to improve enormously the water derived from these rivers.

(*g*) How far it is possible to unify the existing system of storage and to effect radical alterations in the present regulations governing the abstraction of water from the rivers in question, are matters which may seem to lie outside the province of this report; but they have so large an influence on the provision of a uniformly safe and wholesome water supply for London, at a reasonable cost, that it is necessary to mention them.

(*h*) The advantages accruing from adequate storage of water are of a general character, and are not limited to the elimination of danger from typhoid fever.

At the autumn meeting of the Iron and Steel Institute, which will be held at Middlesbrough from the 28th inst. to the 2nd prox., under the presidency of Sir Hugh Bell, Professor Armstrong will contribute a paper on "The Scientific Control of the Fuel Supply," and Professor Bone, of Leeds, and Dr. Wheeler, of Normanton, one on "Gas-Producer Practice."

REGISTER OF PATENTS.

Treating Naphtha and Carburetting Water Gas to Obtain Aromatic Hydrocarbons.

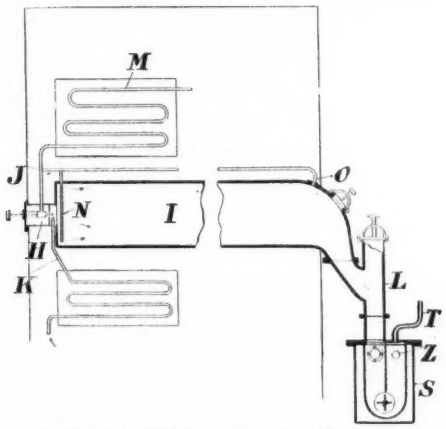
NIKIFOROFF, A., of Moscow.

No. 17,450; July 30, 1907.

According to this invention hy rocarbons obtained by coking naphtha whose boiling points do not exceed 200° C., are "pulverized" in a retort with water gas—the temperature of the pulverized mixture being maintained by an auxiliary supply of heated water gas.

The water gas for "pulverizing" the liquid or gaseous hydrocarbons may be obtained either by blowing air through heated coke or anthracite, so as to obtain generator gas containing 69·8 per cent. nitrogen, 28·3 per cent. oxide of carbon, and 1·9 per cent. carbonic acid; or by blowing superheated steam into the generator gas so obtained, so that a water gas is obtained which has the following composition: About 5 per cent. of nitrogen, 4 per cent. of hydrocarbon, 41 per cent. of oxide of carbon, and 50 per cent. of hydrogen. The generator gas may be used as fuel, while the water gas is used for "pulverization."

The apparatus for "pulverizing" shown in the accompanying illustration consists of three parts: (1) A chamber H where "pulverization" takes place; (2) a retort I where decomposition takes place; and (3) a branch pipe L leading off the vapours and gases.



Nikiforoff's Apparatus for Treating Naphtha, &c.

The chamber H consists of a cast-iron cylinder, one side of which adjoins the retort I while on the other side is a flange; and during the action of the retort this flange is tightly screwed up. A removable partition with an opening in the centre is placed in the chamber. Water gas having the requisite temperature for the decomposition of the gaseous or liquid hydrocarbons enters through a tube J which is connected to a three-way cock from which the gas passes through a taper opening into the retort I, and on meeting the hydrocarbon causes "pulverization." The tube J passes through the flange, and is furnished with a stem to clean the opening in case it gets choked. The hydrocarbon vapours, heated to 200° C. by their passage through a coil, pass through another tube K also having a taper opening. The water gas may pass through a coiled pipe M, so arranged that it can be heated to a temperature of from 800° to 1000° C.

At the entrance of the horizontal retort, a perforated annular pipe is fixed, to which the heated water gas is supplied to mingle with the hydrocarbon and gas issuing from the "pulverizing" chamber; and in order that the mixture at the far end of the retort may maintain the required temperature, a further supply of heated water gas is introduced at this end.

The flow of heated water gas as well as the liquid or gaseous hydrocarbons produced in coking should take place under a pressure of not less than one atmosphere. The vapours of hydrocarbons heated to 200° C. (so called "useful tar") are decomposed by heated water gas.

The temperature of the retorts is maintained by the heated gas escaping through the openings in the annular tube N and from the pipe O at the end of the retort.

The aromatic hydrocarbons which have formed enter a usual washing apparatus S, which is divided into two parts. In the bottom of the apparatus is placed a mixer, which is in action during the whole time of the decomposition. The gas and vapours of uncooled hydrocarbons exhaust from the apparatus through the tube T. Cold liquid—consisting of aromatic hydrocarbons boiling above 200° C.—flows continuously into the apparatus through the tube Z which is furnished with openings. The gas and part of the hydrocarbons which have not been cooled in the apparatus enter condensers and collectors. The liquid from the apparatus S is distilled for obtaining aromatic hydrocarbons in a final state.

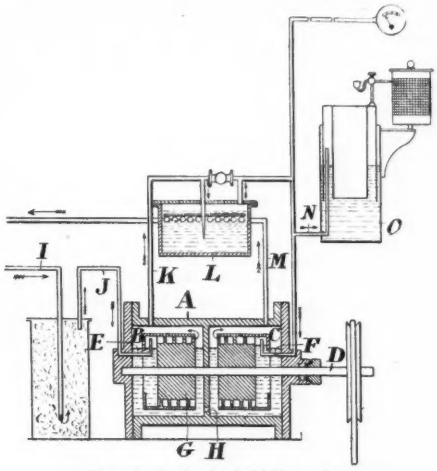
Recording the Percentage of Carbonic Acid, &c., in Gas Mixtures.

THORP, T., of Whitefield, near Manchester.

No. 22,896; Oct. 17, 1907.

This invention for determining and recording the percentage of carbonic acid contained in flue or combustion gases (and which apparatus may also be used for recording the percentage of other gases that can be absorbed or extracted by means of solutions of suitable chemicals from other mixtures of gases) relates to apparatus composed of a duplex pump, an absorption or combining tank, a floating gas-bell (or its equivalent) actuating a registering pen, a revolving or travelling paper band, and pipe connections to the different parts.

The pump consists preferably of two rotary pumps having the same capacity and placed together endways with their drums on the same shaft. These rotary pumps may be like those described in patent No. 23,259 of 1907, like ordinary wet gas-meters (with the drums rotated in the opposite direction to that in which the gas rotates them in such meters), or as represented in the illustration.



Thorp's Carbonic Acid Recorder.

This consists of a horizontal cylinder A divided in the middle of its length into two compartments B C closed by covers. A cylindrical drum is fixed on the shaft D in each compartment, constructed as follows: One end of each drum has a circular opening at the centre, through which the gas is introduced by elbow pipes E F as usual. On the inner circumference of the drum a number of helical channels (preferably four) are arranged, passing one or more times round the drum, and forming a quadruple thread. These may be formed of helical blades attached to the periphery of the drum, which dip into the mercury or other liquid with which the cylinder is filled, so as to leave only a segmental space at the top for the gas. They are, however, preferably formed by webs on a central block G forming rectangular tubes, so as to reduce the volume of gas forwarded by the drums and the quantity of sealing liquid required. The channels are, of course, open at one end to the gas-inlet space in the drum, and at the other end through the end of the drum into the respective compartment of the cylinder. The two drums in the two compartments and their channels are of the same size, and one has preferably right-hand helical channels and the other left-hand ones, with the gas inlets to the two drums through the covers of the cylinder. The partition in the cylinder preferably has an opening H near the bottom through which the compartments communicate so as to keep the mercury in both at the same level.

The gas, the carbon dioxide of which is to be determined, passes from the gas-supply pipe I preferably through a cleaner, thence through the pipe J to the elbow pipe E into the first drum. When the drum shaft is rotated by the pulley at a moderate speed, the drum forwards at each revolution a certain quantity of gas into the compartment B—the volume of gas so forwarded depending on the level of mercury maintained in the drum and compartment. From the compartment B a pipe K leads into the tank L.

This tank is filled to a certain height with the absorbing solution. In it there is preferably a floating plate or board, to the underside of which a spiral formed of a coiled wire is attached. The pipe K dips into the liquid and allows the gas forwarded from the compartment B to escape through a small nozzle and pass in small bubbles along the spiral or in the grooves formed by it from the centre to the outside and into the upper part of the tank L. The float causes the coil to be always immersed in the absorbing liquid, which, when the apparatus is used for determining the percentage of carbon dioxide, is an aqueous solution of caustic potash. This combines with the carbon dioxide in the gas, and thereby correspondingly reduces the volume delivered to the absorption tank. As the channels and drums of the two pumps have the same size and capacity, and the compartment C above the right-hand drum is, through the pipe M, in communication with the atmosphere, so that the pressure in it equals that of the gas supplied to the apparatus, the mercury in the drum in the compartment C rises to reduce the gas volume in the drum, and the pressure of the residual gas drawn into the drum is reduced in proportion to the difference of the levels of the mercury outside and inside the drum.

This reduction of pressure and the corresponding percentage of carbonic acid are registered in the following manner: From the pipe leading from the absorption tank L to the elbow pipe F a pipe N is branched off and connected to the stand-pipe of a small gasholder O. The bell of this holder is supported by a float, preferably formed by an internal cylinder closed at the bottom and fixed to the top of the bell as shown. When the gas in the bell is at atmospheric pressure, the bell will occupy a certain position in the tank; while if the pressure is reduced, the bell sinks proportionally. To the top of the bell a rod is fixed carrying a pencil by which these changes of position are marked on a revolving band passing round a vertical drum rotated at a uniform slow speed. The drum may be driven from the rotary pump shaft D or by clockwork. In this manner a continuous record of the percentage of carbon dioxide in the gas is obtained.

Retorts for Producing Illuminating Gas, Coke, &c.

GLOVER, THOMAS, of Norwich.

No. 17,875; Aug. 6, 1907.

A full abstract of this specification appears on p. 570.

Hot-Coke Conveyors.

BERLIN-ANHALTISCHE MASCHINENBAU-ACTIEN-GESELLSCHAFT, of Berlin.

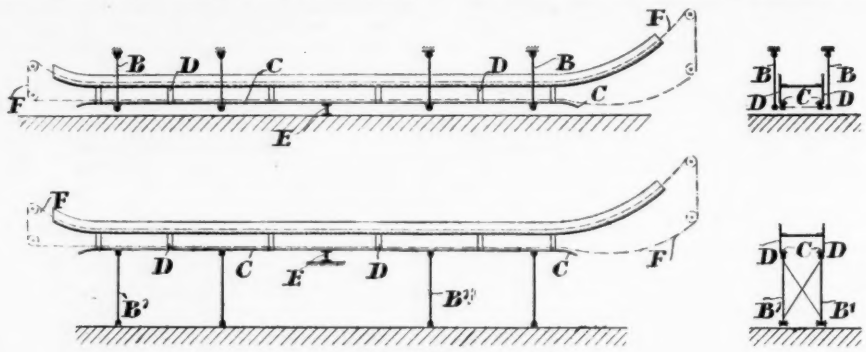
No. 10,601; May 15, 1908. Date claimed under International Convention, Nov. 15, 1907.

The object of this invention is to provide a trough or channel which will not be distorted by the heat of the incandescent material—a drawback more particularly noticeable in the case of troughs used in connection with vertical retort installations or furnaces where it is necessary to convey exceedingly large quantities of coke, as "the ill-effects are naturally more evident when the incandescent material, owing to interrupted working, has not advanced in the channel but is allowed to remain there for a long time, until it can be extinguished by hand."

The channel or trough suggested is rigidly supported at one point only in its length, and is otherwise carried on pivoted links or rods; so that when it is heated and expands it can yield to the strain acting on it.

Two such constructions of conveyor channel or trough for coke are illustrated.

In the first form shown, the trough or channel is suspended on pivoted



A German Hot-Coke Conveyor.

links B arranged at suitable distances apart. The under portion C of the trough is connected to the trough proper by links D or the like, and is rigidly secured to a girder E or other similar support only in the centre of its length. The coke in the channel is conveyed by means of a chain or similar conveyor passing over guide rollers.

In the second construction, the channel is mounted on pivoted rods B^1 secured to the under portion; and, as before, the trough is fixed only at its centre by being secured to a girder E or the like.

In both cases the channel is thus rigidly secured at one point only, and on being heated it freely expands in either direction without damage to the plates of which it is formed. Should it expand, the supporting links B B^1 will "only be oscillated to a very small extent."

Instead of being fixed at its centre, the trough may be secured at one of its ends; but the construction illustrated (wherein the fixed support is in the centre) is preferred "on account of the more favourable distribution in most directions of the strains produced." It is, of course, necessary to make the drive of the conveyor chain F so that it adapts itself as much as possible to the expansions of the links. To this end the chain is preferably driven by an adjustable driving belt or by a belt having some automatic tightening device; the drive being effected direct from a motor or from a countershaft as found convenient.

Substance or Mixture for Treating Coal.

JOWETT, J., of Bolton-le-Sands.

No. 8578; April 18, 1908.

This invention relates to an improvement on, or addition to, patent No. 14,893 of 1907 [see Vol. CII., p. 442], which has for its object the treatment of coal by chemicals for fuel and gas manufacture—the improved fuel being in the form of coke. Apart, however, from the improved fuel resulting from the treatment of coal as described, the patentee now says his further experiments have proved conclusively that the chemicals then named used dry, and not in solution, during the process of gas manufacture, has "an undoubted beneficial effect on the gas production, both as to the quality of the gas and the elimination therefrom of certain impurities, without detriment to the residuals or bye-products resulting from gas manufacture." His present improvement consists, therefore, "in the use of certain chemicals in a dry state—that is, in a powder, and the application of powder, crystals, or the like, to the coal placed in gas-retorts in the usual manner."

The chemicals used are the same as those described in the earlier application—namely, chlorate of potash, saltpetre, and permanganate of potash. To these chemicals may be added chlorate of soda, "which, combined with the other ingredients, has the effect of considerably reducing the quantity of sulphuretted hydrogen given off with the gas during manufacture, though it must be understood that the chlorate of potash, saltpetre, and permanganate of potash have also a beneficial action on the sulphuretted hydrogen." Further, each chemical used alone will, it is said, have a beneficial effect on the gas resulting from its manufacture; also a good result will be obtained by using the chemicals one after the other—that is, it is not essential to mix the chemicals intimately before throwing them on to the coal.

The order in which the chemicals affect or reduce the sulphuretted hydrogen is said to be as follows: (1) Chlorate of soda; (2) saltpetre; (3) chlorate of potash; (4) permanganate of potash. The effect of the latter is, however, very small. Any two of the chemicals may be combined together. The quantity of chemicals used and their proportions will vary with the quality of coal; but for an average quality of gas coal, it is found that 10 oz. of a dry mixture of chlorate of potash, 4 oz. of chlorate of soda, 6 oz. of saltpetre, and ¾ oz. permanganate of potash per ton of coal will give the desired result—that is, 20 oz. per ton.

The retorts are charged in the ordinary manner; and before closing the retort-lids, a packet of the chemicals or powder is thrown into the retort, and the lids closed. "The action of the chemicals under heat is to throw off a gas heavier than coal gas, through which the coal gas rises and passes up the ascension pipes. The passing of the coal gas through the heavy gas causes the coal gas to be to a certain extent purified of certain impurities, such as sulphuretted hydrogen. As the coal gas ceases to be given off, the heavy gas falls, and passes through the coke, purifying the same in its downward course, and supplying oxygen thereto. The coal gas given off will be found to be purer and of an increased quantity than that given off in the ordinary process of gas manufacture, apart from the improvement in the fuel or coke remaining in the retort, which is withdrawn in the ordinary manner." The varying proportions and quantities of chemicals used will vary from a maximum total weight of 37 oz. per ton of coal to a minimum weight of 18 oz.; the maximum weight being divided as follows: 12 to 16 oz. of chlorate of potash; 8 to 12 oz. of chlorate of soda; 12 oz. of saltpetre; and ¾ oz. of permanganate of potash. The minimum weight is made up in the same proportions.

The patentee concludes his specification thus: "I am aware that in my former application, the intimate mixture of the chemicals alone and coal, was foreshadowed with a view to the production of an improved fuel or coke; but I have considered it desirable to make same the subject of a further application in view of the action of the chemicals on the coal gas produced in gas manufacture, wherein the chemicals are used dry, substantially in the manner described. Further, the use of the mixture of chemicals applied to the fuel in the furnaces of gas-retorts used for the carbonization of the fuel in the retorts, produces an increased heat and therefore quicker and better carbonization."

Manufacture of Incandescent Gas-Mantles.

SIMONINI, A., of Salzburg, Austria.

No. 10,233; May 11, 1908.

This invention relates to the manufacture of incandescent gas-mantles of "artificial silk," which are said to "surpass in strength and durability all other mantles heretofore described."

The artificial silk is first subjected to a washing process in which the webbing, if not of a bright white colour, is bleached and then treated with diluted hydrochloric acid. After washing with distilled water, the last traces of acid are neutralized with ammonia. The webbing is then dried and saturated with a strong solution of thorium nitrate and cerium nitrate, in the proportion of about 98¼ to 99 per cent. of thorium nitrate and 1¾ to 1 per cent. of cerium nitrate. After drying, the saturated web is either dipped in a mixture of ammonia and hydrogen peroxide or first immersed in strong ammonia for about five minutes and then rinsed, and after that immersed in hydrogen peroxide. After rinsing again and drying, the webbing is incinerated in a bunsen flame.

Any of the artificial silks—such as denitrated, nitrocellulose, or cuproammonium cellulose or viscose silk—may be used. When following the treatment described, the saturated webbing shows a permanent bright yellow colour owing to the peculiar hydration and superoxidation of the cerium nitrate; while the quality of the final product depends on the properties of the saturated and treated webbing before incineration. This product differs materially from that obtained by the treatment of the saturated webbing with either ammonia alone or hydrogen peroxide alone, as proposed by other inventors. The treatment of the nitrates with ammonia produces hydrates of the same stage of oxidation as the nitrates are in the webbing—that is, it produces the hydrates of the lower oxides. Treatment of the nitrates in the webbing with hydrogen peroxide only produces a hydrate of thorium of a higher stage of oxidation, but does not hydrate or oxidize the cerium nitrate—it dissolves it.

The combined treatment of the nitrates with ammonia and hydrogen peroxide turns the cerium nitrate into a hydrate of a higher stage of oxidation—a well-known chemical fact. The webbing, therefore, becomes bright yellow. The thorium nitrate is converted into a hydrate, the stage of oxidation of which has not yet been determined. It is also a well-known fact that hydrogen peroxide produces various degrees of oxidation, according to whether it is employed in acid or alkaline solution. In this case, the oxidation takes place under alkaline conditions. Whatever the stage of oxidation of the thorium hydrate may be, it is a fact that the incinerated mantle is denser and more contracted than is the case with the artificial silk mantles as heretofore described, and it is said to possess considerably more strength and durability.

We have received from the American Spiral Pipe Works of Chicago a pamphlet (No. 22) illustrating the different purposes for which Taylor's spiral-riveted pipe is specially adapted. It is claimed for this pipe that, owing to its mechanical construction, it is from 30 to 50 per cent. stronger, gauge for gauge, than any other riveted pipe. It is made in different gauges up to 0·25 inch thick.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Visit of Junior Gas Associations to London.

SIR,—May I avail myself of your columns to convey my appreciation of the many thanks I received to-day fromthe various friends in connection with the above visit? I have not been able to do so personally; neither did time, owing to the length of our programme, permit me to make the acquaintance of all those I wished to know. I should like also to express my sympathy with the Midland members, who were kept on the railway an hour and a half beyond the scheduled time; thus preventing them from attending the conference in the Congress Hall at the exhibition.

With regard to the small part I played in Saturday's arrangements, I had heard much of the hospitality displayed to the London and Southern District Associations during the visit to Manchester, and I set out to endeavour to outstrip them in their kindness, but did not know what a difficult task I had given myself.

W. J. LIBERTY, Hon. Sec. of the Reception Committee.

Dulwich, S.E., Aug. 29, 1908.

The Rational Analysis of Clays.

In the "JOURNAL" for the 18th ult., we gave the principal portions of an article on the above subject prepared by Dr. J. W. Mellor, of Tunstall, for the September issue of the "Pottery Gazette." An advance proof was sent to Mr. F. J. Bywater, whose paper at the annual meeting of the Institution of Gas Engineers gave rise to Dr. Mellor's communication; and he has sent to our contemporary the following reply, to appear concurrently with the article.

To the Editor, "Pottery Gazette."

Sir,—I am indebted to the courtesy of yourself and Dr. Mellor for providing me with an advance copy of his article on the "Rational Analysis of Clays," to appear in your next issue, and beg the privilege of your columns to make the following observations in reply thereto.

I am sorry Dr. Mellor does not do me the honour of paying the same attention to the remainder of my paper as he does to one or two analyses quoted. Had he done so, he would have readily seen that the claims I make for the "rational analysis" are by no means so far-reaching as he supposes. It may be noted parenthetically that Dr. Mellor appears to be at considerable variance with some experts of the ceramic industry, who have made inordinate claims for this method of analysis. Of such differences, I am not aware; neither, except as pointing a warning for the future, are they very *à propos* of the present discussion.

I think one or two quotations from my paper will make my position clear. I said: "The whole question of the constituents which the refractoriness of clays bears to the chemical analysis is a most intricate one. . . . The general practice has been to consider the refractoriness to be in direct ratio to the percentage of silica present, as found by ultimate analysis, and the absence of impurities," &c. "A complete analysis . . . assumes clays to be homogeneous chemical compounds, which they most certainly are not. . . . They are, instead, mechanical mixtures of the various processes of weathering. . . . By separating the clay into its mineralogical constituents, a far more accurate knowledge will be obtained. . . . To complete the investigation of the clay on these lines, a mechanical analysis is also most helpful. . . . To sum up, then, it may safely be stated that the ultimate analysis of a clay, *as usually employed*, is of very little use in arriving at a proper estimate of refractoriness, and that far better knowledge is that based on mechanical and 'rational' methods . . . when ultimate analysis may be employed. If examined in a proper manner, much information can be obtained by an intelligent study of chemical analyses. These should, however, be combined with experimental investigations. Practical tests conducted so as to approximate to working conditions are strongly recommended," &c. This is the position I have taken up with regard to the various methods of testing and analysis.

Dr. Mellor contends that the rational analysis is unreliable, and gives as examples the analyses quoted to show that the alkalis given by the ultimate analysis do not correspond to the feldspathic constituent given by the rational method. I am not disposed to disagree with him very much as to the occasional defects of the rational analysis; but does he claim anything more for the calculation method he recommends? Of this he says: "The multiplication of the 'comparatively large' errors in the determination of small quantities of bases renders it necessary to label the process *approximate*. Can the rational analysis do more?" Assuredly it can do as much. Dr. Mellor later on says: "There is no known accurate process for the general determination of the exact mineralogical constituents of clays; and I am not sanguine of its discovery in the immediate future." Had he continued, "and there is no chemical method likely to be invented which will treat clays in a really satisfactory manner," I should have agreed with him entirely.

The argument throughout my paper was that the constitution of fire-clays is so intricate, and their formation was subjected to so many and various influences, that chemical investigation alone is of limited use. Further, assuming that both methods are approximate, is there very much difference between us? Dr. Mellor favours the resolution of the clay into its mineral constituents; and so do I. If we differ as to the method employed in doing so, and Dr. Mellor admits that the calculation from the ultimate is "approximate," I am quite sure I have made no more definite claim for the "rational analysis."

I am aware that Aron Seger and others made very definite claims for the rational analysis, and based their theories on laborious researches extending over many years, and covering large numbers of clays; and although some of these claims may have proved untenable when applied to other clays, no one can gainsay the tremendous beneficial effect which this work has had on the clay products of present-day German manufacturers. It has fixed firmly in their minds the great value of regarding clay as being composed of three main parts—*i.e.*, clay, quartz, and felspar. The habitual resolution of clays into these constituents has caused them to attempt the production of mixtures of clays to obtain theoretically perfect products; and their efforts have met with very great success.

Contrast this with the methods employed by 95 per cent. of the fire-brick manufacturers of this country. Where analysis is used at all, the ultimate analysis is supreme, and there is practically no regard paid to the mineral constitutents. Granting that the ultimate analysis can be conducted with precision, I contend that it is of little more use than a chemical exercise as now generally conducted and employed by fire-brick manufacturers. Such analyses as the one of the Stourbridge clay, with which Dr. Mellor rightly finds fault, would never be tolerated were there a proper understanding as to the mineral constituents. Such information is continually prominent where rational and mechanical analyses are employed; and although it may be admitted that both have shortcomings, these are unimportant compared with the overwhelming advantages accruing from the information they impart.

Dr. Mellor's communication would allow of the inference that the fire-brick manufacturers of this country were divided into two camps—those who favour ultimate and rational analysis. As a matter of fact, very much the reverse is the case. My experience is that rational analyses are practically unknown to English fire-brick manufacturers. Where analyses are used the ultimate analysis is invariably employed alone; and it appears to me certain that the reign of "rule of thumb" has been considerably lengthened by the proved futility of the information generally obtained therefrom.

I beg to reaffirm my contention that the ultimate analysis, as now generally employed, is of very little use, and that far greater advantages will accrue to fire-brick manufacturers by getting fixed ideas as to the general mineral constituents of the clay. Careful scientific advice and investigation are, however, essential; and it is certain that nothing but good can come to all concerned from very much closer technical investigation than is at present employed. As to this latter necessity, I am glad to learn that Dr. Mellor is in agreement with me, and that there is now a movement on foot in the ceramic industry to promote a conference such as is proposed between gas engineers and fire-brick manufacturers. I trust it may be possible to join forces for the common good. It is one of the first principles of progress that the reasonable demands and requirements of any industry should be clearly and accurately stated; and scientific investigation rarely fails to provide the means for obtaining these desired results. Such conferences as are proposed will enable each industry to formulate its requirements; and by bringing them into touch with those who have to supply these requirements, nothing but good can result.

F. J. BYWATER.

Saltley Gas-Works, Birmingham, Aug. 29, 1908.

LEGAL INTELLIGENCE.

CHARGE FOR WATER IN THE CITY OF LONDON.

Metropolitan Water Board v. Samuel.—No Notice of Change Required.

At the Mansion House Police Court, last Thursday, before Alderman Sir Horatio D. Davies, Mr. Vivian Samuel, who carries on business at No. 65A, Gracechurch Street, E.C., was summoned by the Metropolitan Water Board for £4 11s. 9d., which they claimed was due to them for water supplied to his premises for the quarter ended June 30. As has already been explained, this action was the result of a dispute between Mr. Samuel and the Board in consequence of the levelling-up of the water charges in the City. Finding that his water-rate would be largely increased under the new scale, Mr. Samuel determined to cease taking a supply from the Board, and to get what water he required from the Aldgate Pump; and he tendered payment to the Board of the amount that would have been due, at the old rate, up to the time when his supply was cut off. This, however, they declined to accept in settlement.

The plaintiffs were represented by Mr. H. COURTHOPE-MUNROE (instructed by Mr. D. Collins, Assistant Solicitor to the Board); while Mr. GEORGE KEBBELL appeared for the defendant.

Mr. COURTHOPE-MUNROE explained that the premises in respect of which the quarter's water-rate at the new charge of 5 per cent. was claimed stood at a rateable value of £459, off which, of course, a rebate was allowed. Under the old condition of things, the amount charged was 3 per cent.; but by the Board's Charges Act of 1907, since April 1 last, the whole of the rates had been pooled, and now everybody had to pay the 5 per cent. charge. This had affected various parts of the water supply area in different ways. Mr. Samuel had taken a considerable part in the agitation against the revised charges. When application was made for the rate for the six months April 1 to Sept. 30 at the increased charge, he at once wrote objecting to it, and required the Board to cut off the water. This they did on June 10; and Mr. Samuel thereupon became liable to pay for one quarter only—to the end of June. He tendered the amount at the old rate, less the two weeks from June 10 to June 24; but it was pointed out to him that he could not legally split a quarter. Thereupon he tendered an additional sum for the two weeks, but still at the 3 per cent. rate. The Act of 1907, by which the uniformity of charges was provided for, came into operation on April 1; and by section 15, the dates of payment were altered from the usual quarter days to April 1, July 1, Oct. 1, and Jan. 1. Section 6 provided that, in order to make uniform throughout the limits of supply the obligations of the Board with respect to the supply of water, the Acts specified in a schedule to the Act should be repealed to the extent set forth, but "that all rates, rents, and charges due or accruing due to the Board down to the commencement of this Act may be collected, sued for, and recovered as if this Act had not been passed." They started on April 1 with all previous legislation regarding rates, and so forth, swept away.

Sir HORATIO DAVIES: Were the Board generous enough to forego the amount that would be due between March 25 and April 1?

Mr. COURTHOPE-MUNROE said he could not answer this off-hand; but he thought it would be found that they were. There would probably be no rate levied for that week. Section 3 of the 1907 Act incorporated the provisions of the Water-Works Clauses Act, 1847, for the collecting of the rates. Under section 68 of the 1847 Act, water-rates were payable according to the annual value; but this had, of course, since been altered to rateable value. By section 74 of the Metropolitan Water Board Various Powers Act, also passed in 1907, the Board were empowered to inspect valuation lists, &c., for the poor and other rates, so as to obtain evidence of the rateable value of premises supplied with water; and in this way they had ascertained that the premises in question were rated at £459. Returning to the Act of 1847, section 70 said that the rates should be paid in advance by equal quarterly payments; and the first payment should be made "at the time when the pipe by which the water is supplied is made to communicate with the pipes of the undertakers, or at the time when the agreement to take water from the undertakers is made." Thus even under such old legislation as 1847, water-rates stood upon the peculiar footing that they had to be paid in advance; and it was important to bear this in mind. From April 1, the new Act varied the charge that could be made; and he understood that the suggestion of the defence was that it was someone's duty to go and inform consumers that Parliament had altered the law. This was not, however, the case; the consumer had to find it out for himself.

Sir HORATIO DAVIES: Was it not rather thrown on the Water Board to inform the public what their percentage charge was to be?

Mr. COURTHOPE-MUNROE replied that it was not, for the reason that the water-rate was paid in advance. It was not like gas or electricity. Parliament had placed on persons who supplied water very onerous obligations as to watering streets, &c.; and therefore the rates stood on a different basis to others. The rate was payable in advance; and the percentage to be charged was to be ascertained by the person who wanted water. He must go to the people who supplied it, and say: "I want water; what is the charge?" Though the old Water Companies and the Water Board could, of course, adhere to the strict letter of the law, and compel a person to pay the money down or cut off his water, they did not do so. What they did do was always to collect the rate one quarter in parliamentary arrear, so to speak, and one quarter in advance. In this case notice was sent to Mr. Samuel on or about May 20 that the water-rate on his premises for the two quarters to Sept. 30 at 5 per cent. on the rateable value, less 20 per cent. rebate, was £9 3s. 7d., of which payment should be made.

Sir HORATIO DAVIES: What I particularly want to know is when the notice was given that the Board were going to raise the charge for water from 3 to 5 per cent.

Mr. COURTHOPE-MUNROE: This notice was sent out *ex gratia* on or about May 20.

Sir HORATIO DAVIES: You say it was my duty as a water-rate payer to call upon the Board and ask what they were going to charge for their water?

Mr. COURTHOPE-MUNROE: If you need water, you are bound, before you are entitled to have it, to go and say you want it, and to tender the money; and if by April 1 the money had not been paid or tendered, and the Board had cut off the supply, they would have been within their legal rights.

Sir HORATIO DAVIES: That I quite understand. I think it would be as well sometimes if they gave us that wholesome lesson; then we should know where we were. But I do think it was the duty of the Board to inform consumers on the date they were going to raise the price of their water.

Mr. COURTHOPE-MUNROE: Of course, the Water Board are a public body; and their proceedings are open. On Dec. 20, the Board had a meeting to put into force sections 8 and 9 of the 1907 Act—that is, to settle the percentage and the rebate.

Sir HORATIO DAVIES: It seems to me the only point I have to decide is as to the notice.

Mr. COURTHOPE-MUNROE: It might be a moral point; but as far as the legal aspect of the matter is concerned, I hope I can satisfy you that there is nothing in it. Continuing, he said section 8 of the 1907 Act empowered the Board to make a charge for water for domestic purposes at a rate per annum not exceeding 5 per cent. of the rateable value; and section 6 repealed the earlier Acts, in order to secure uniformity—thus bringing the 3 per cent. to an end. Supposing the Board had taken no steps up to April 1, 1908, there would have been no power to charge anything. The old 3 per cent. had ceased to exist. On April 1 a new charge had to be created under section 8 of the Act; and the rebate, under certain conditions, on domestic supplies to business premises (which was not to be more than 30 per cent. or less than 20 per cent.) had to be fixed. On Dec. 20, the Board discussed the matter, and resolved that the charge for domestic supplies should be 5 per cent., and the rebate 20 per cent.

Sir HORATIO DAVIES: It seems to me the question we have to decide is whether it is my duty as one of the public to go to the Board and ask what percentage would be charged, or whether it is the duty of the Board to acquaint every householder with the amount. It seems to me the fact of their having on May 20 sent out a notice that they were raising the charge from 3 to 5 per cent. shows they thought the responsibility rested with them, and not that the public should go to them.

Mr. COURTHOPE-MUNROE pointed out that it was impossible to fix on a statutory body a duty to do anything unless it was to be found within the four corners of their Act. Because the defendant did not obey the Statute and tender the money on April 1, and because the Board did not act unreasonably and cut off the supply, Mr. Samuel could not, when he heard of the increased charge, be put in a better position than if he had complied with the Act, or the Board had acted arbitrarily. The Board were under no legal obligation to send out the notice to which he had referred. Though they might have sent it out on March 20 instead of May 20, there was nothing in the Act to compel them to do so at all.

Sir HORATIO DAVIES: If there is no obligation on the part of the Board to give the public notice that they are going to vary the charge, I shall know how to deal with the case.

Mr. *William S. Fleming*, an Assistant Cashier at the City Receiving Office of the Board, said the notice was sent on May 20 to defendant, who then wrote protesting against the increased charge, and stating that he wished the water to be immediately cut off from his shop. On June 10 this was done; and on July 6 defendant sent the money for one quarter at the 3 per cent. rate, less the two weeks from that date to June 25. When it was pointed out to him that he could not split up a quarter, he sent on the amount for the remaining two weeks, also at the old rate.

Cross-examined by Mr. KEBBELL, witness said there was a dispute between the defendant and the Board in the summer of 1906; and eventually the parties came to terms.

Mr. KEBBELL said that on Nov. 14, 1906, the Supervisor to the Board wrote Mr. Samuel, confirming an arrangement verbally come to, by which an order to withdraw the supply from his premises had been withheld, in consideration of Mr. Samuel agreeing to pay until further notice from him (Mr. Samuel) a charge at the rate of 3 per cent. per annum on £324–£9 14s. 4d., with 12s. for a closet, or £10 6s. 4d. in all. The letter pointed out that, as the rateable value of the premises was £459, Mr. Samuel would thus be enjoying a considerable advantage. In reply, Mr. Samuel agreed to make the payment named until further notice. This Mr. Kebbell argued constituted a written agreement; and the amount tendered by defendant for the quarter in dispute was, he said, in accordance with that agreement.

Mr. KEBBELL (to witness): Now, will you tell me of any way in which the agreement has been put an end to?

Witness: I do not know.

Sir HORATIO DAVIES: Did not the new Act of 1907 do away with the old one?

Mr. KEBBELL said section 6 of the new Act provided "that all rates, rents, and charges due or accruing due to the Board down to the commencement of this Act may be collected, sued for, and recovered as if this Act had not been passed." The Act came into force on April 1; but this quarter's rate to Midsummer became due on March 26—five days before—according to the law as it stood then. The new Act was of no value or effect until April 1; and the matter of March 26 must be treated as if the Act had not been passed. Therefore the rate due on March 26 was according to the old law.

Sir HORATIO DAVIES: The Act of 1907 does away with anything like an agreement such as you have there. The only point is whether the Board were compelled by Act of Parliament to make it known to the consumers that the charge was to be at a certain rate on a certain date. Can you show me anything that makes it obligatory on the part of the Board to do so?

Mr. KEBBELL: There is an agreement entered into in 1906, and acted upon since that date, which has never been put an end to. It was an agreement which the Board were perfectly able to enter into under the Statute. In fact, under section 24 of the Act of 1907, the Board "may by agreement with any person or body desiring a supply of water for any purpose in any part of the limits of supply furnish such supply upon such terms and conditions as to payment and otherwise as may be agreed upon." They can enter into any agreement; and here is an agreement actually in operation when the new Act comes into force. In default of the Board putting an end to it, it must be taken as binding—it must be taken in law and common-sense that they continued the agreement.

Sir HORATIO DAVIES: Let us confine ourselves to the one point that has to be decided. Can you show me by any Act of Parliament that it is obligatory on the part of the Water Board to let your client know what they are going to do, or is it his duty to find out for himself?

Mr. KEBBELL: Mine is a unique case. Here there is an agreement.

Sir HORATIO DAVIES: Well, I have decided it is no agreement. It is over-ridden by the Act of 1907.

Mr. KEBBELL: I defy anyone to show a word in the Act that overrides the agreement. Section 8 says the Board may charge at a rate not exceeding 5 per cent.; and the amount named in the agreement does not exceed 5 per cent. It would be a monstrous injustice to say that because they had the power to do a thing, they could do it without a word of warning.

Mr. KEBBELL (to witness): You agree there was the letter agreeing to the payment of £10 6s. 4d.

Witness: It is the first I have seen of it.

Mr. KEBBELL: At that time—in 1906—was Mr. Samuel paying at the rate of £2 14s. per annum, or about one-eighth of what you are asking him to pay now?

Sir HORATIO DAVIES: We are all paying more. It is always the case when these things get into the hands of the public instead of those of private individuals. But that we are not trying to-day.

Mr. KEBBELL: As far as you know, nothing has ever transpired to put an end to the agreement of 1906?

Witness: That is so.

Sir HORATIO DAVIES: Except the Act of 1907.

Mr. KEBBELL: I want to ask you whether the sum of £4000 was authorized to be expended in order that the consumers might have notice of the change?

Witness: I do not know.

There were many written agreements in existence in April last?—I do not know.

Do you not know as a fact that the Board had entered into many written agreements with consumers similar to that now in question?—Under the old Act, I believe so.

Sir HORATIO DAVIES: You are ploughing the sand. Whatever agreements may have been in existence previously, the Act of 1907 did away with them.

Mr. KEBBELL: Do you not know that whenever it was intended to put an end to one of these agreements, written notice was sent before April 1?

Witness: I do not know the procedure.

Do you say seriously you never saw a notice from the Board putting an end to a written agreement before April 1?—I have seen notices in respect of agreements for metered supplies; not domestic supplies.

In consequence of the Act of 1907, the Board, previous to April 1 gave notice where they intended to put an end to meter agreements?—Yes.

Sir HORATIO DAVIES: But it comes back to my point—was it obligatory on their part?

Mr. KEBBELL: Well, it shows they thought so.

Mr. COURTHOPE-MUNROE: The idea of calling the letter of 1906 an agreement strikes me as being rather comic.

Sir HORATIO DAVIES: Well, if it was an agreement, it was quashed. All I ask Mr. Kebbell to do is to show me that it is compulsory on the part of the Board to give notice of the change of rates to the consumers. He has not done so yet.

Mr. KEBBELL: With great respect, I say that is not the point.

THE DECISION.

Sir HORATIO DAVIES: I think it would be a waste of time to put Mr. Samuel in the box. I have listened to the arguments on both sides; and I have come to the conclusion—with some regret to myself and the public generally, but we cannot help that, we must take things as they are—that all I can do is to make an order for the amount claimed; this amount to be adjusted between the Board and Mr. Samuel. Whatever may be the amount that is due, it is to be paid.

The CLERK said the amount on the summons was £4 11s. 9d., with 2s. costs.

Mr. COURTHOPE-MUNROE said that as the matter had been fought as a test case, he hoped the Court would give him something more for costs. The Board had been brought there at some expense.

Sir HORATIO DAVIES declined to make any further order.

In the course of the hearing, Mr. Kebbell intimated that the case might be taken elsewhere; but after the Alderman had given his decision no formal application was made in the matter of an appeal.

Provision of Water-Fittings for Constant Supply.

The Kingston-on-Thames Magistrates had before them last Friday a summons taken out by the Metropolitan Water Board against Mr. Percy Nesbit, of "Hollywood," Cadogan Road, Surbiton, for failing to comply with their requirements with regard to the water-fittings on his premises. Other residents in Surbiton were similarly summoned; and this was in the nature of a test-case. Mr. H. Courthope-Munroe, who appeared in support of the summonses, said the Surbiton Urban District Council had exercised their statutory power under the Metropolis Water Act, 1871, and had demanded a constant supply of water for Surbiton. The Board were willing to furnish it; but, by the Act, they were bound to insist that certain regulations with regard to the water-fittings on the consumers' premises should be complied with before it was given. Notices had been sent out requiring the provision of new fittings in houses where they were necessary; but, though the Surbiton people appeared to be anxious to have a constant supply, they were not in a hurry to bring their premises into a condition consonant with the regulations. There were 3500 premises in Surbiton, and when the Board's inspectors went round to ascertain if the fittings were satisfactory, they found that only 1100 were right. Mr. Patrick Shaw, who appeared on behalf of Mr. Nesbit, raised an objection to the summons on the ground that the regulations did not apply to Surbiton until 1897, and that many of the fittings, being on the premises before that year, were prescribed fittings under the Act of 1871. The Bench, however, overruled the objection. Evidence was then called as to the character of the fittings on the defendant's premises; and on three of the five summonses against the defendant the Bench imposed a nominal fine of 1s., and ordered the regulations to be complied with—the Chairman (Sir Charles Scotter) stating, however, that they would give the defendant every possible facility for appealing. A similar decision was given on summonses against Mr. R. A. Hewat, of Adelaide Road, Surbiton. The summonses against the other defendants were withdrawn.

Tamworth Water Supply.—A meeting of the Tamworth Joint Water-Works Committee was held last Tuesday, when the accounts for the year ended March 31 were presented. The working account showed that the gross profit for the year was £2009. The water-rents had produced £3437; and the sums handed over to the authorities as their share of the profits had been £1342 to the Rural District Council and £757 to the Town Council. To the capital outlay £34,278 on the undertaking there had been added during the year £120, principally expended for mains.

Suicides by Coal Gas.—On Monday last week, Herbert Edwards (22), a butcher, residing in Newland Avenue, Hull, committed suicide by inhaling coal gas. Deceased had been drinking heavily, and had been in bed since an early hour the previous Saturday evening. In the afternoon of the above-named day, a faint odour of gas being detected near his bedroom, the apartment was entered, and he was found with his head under the bed clothes, and near his nostrils a tube 5 feet long leading from a gas-bracket, the tap of which was turned on. A medical man was called, and he pronounced life extinct. At the inquest, it was stated that when under the influence of drink deceased had threatened to destroy himself. A verdict of "Suicide while of unsound mind" was returned. The Liverpool Coroner held an inquiry last Thursday concerning the death of William Lancashire (37), a blacksmith's striker, living at Wavertree, who committed suicide by inhaling coal gas from the bracket in his kitchen. It was stated that the deceased had been out of work for five weeks, and in consequence had been very low-spirited and strange in his manner. A verdict of "Suicide while temporarily insane" was agreed upon. Last Thursday morning, Mr. H. Llewellyn Rogers, a retired solicitor of Swansea residing at Bournemouth, was found dead in his room. The body was stretched upon a kitchen table with one end of the inner tube of a bicycle tyre lying across the breast, the other having apparently been connected with a penny-in-the-slot cooking-stove, the tap of which was full on, but the supply of gas exhausted. On the evening of Friday, the 21st ult., a respectable-looking man, apparently between 40 and 50 years of age, who did not give his name, engaged a bedroom in a temperance hotel in Perth. In the morning he did not respond when called, and on the room being entered the man was found dead in bed. A doctor certified that death was due to poisoning by gas, of which the room smelt strongly, and a tap was found turned on.

MISCELLANEOUS NEWS.

AUSTRALIAN GASLIGHT COMPANY.

The Annual Meeting of this Company was held at the Royal Exchange, Bridge Street, Sydney (N.S.W.), on Monday, the 27th of July—Mr. G. J. COHEN, the Chairman of the Company, presiding.

The SECRETARY (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report of the Directors was taken as read. It was stated therein that the profits for the past half year to June 30, after making provision for bad and doubtful debts, deducting interest on borrowed money, repairs and renewals, depreciation of plant, working expenses, and all other charges, amounted, with the balance brought forward, to £67,193; and the Board recommended the payment of a dividend for the six months of 9s. per share on the old shares, and in proportion on the new shares, free of income-tax. This would absorb £60,000, and leave a balance to be carried forward of £7893.

The CHAIRMAN, in moving the adoption of the report and accounts, said that at the meetings for some time past it had been his pleasure to refer to the continued progress in the Company's business; and on the present occasion he had again to congratulate the shareholders in a similar direction. The increase in the consumption of gas during the past half year had been about 6 per cent. over the corresponding period of 1907—equal to 53,000,000 cubic feet; the total quantity sold in the six months having been 959,000,000 cubic feet. The increases during the last few years had greatly taxed the manufacturing resources; but the near completion of the No. 2 retort-house at Mortlake would enable them to keep pace with the increasing demand for gas. The extension had taken much longer to carry out than originally contemplated, consequent upon a delay in the delivery of the machinery from England. However, everything would be in working order early next month. The termination of the miners' strike at Airlie, in May last, enabled the Commonwealth Oil Corporation to resume their deliveries of oil, thus placing the Company in a position to again bring into use their carburetted water-gas plants, which had been idle for many months. The use of gas for cooking, heating, and other purposes apart from lighting, was steadily on the increase—so much so that the consumption throughout the day and night was nearly equal, the former being over 46 per cent. of the total output. This uniformity in the gas consumption was exceedingly gratifying, and was a great factor in the successful working of the Company; it being always most unsatisfactory when the mains were not utilized to their full extent during the whole of the 24 hours. During the past half year the showroom staff had been busily employed in meeting the demands for gas appliances, particularly gas-cookers, the total sales of which, during that period, reached 707, an increase of 164 for the six months. A great many cookers had also been sold by representatives of makers, other than the "Eureka" stove imported by the Company; so that it was quite impossible for him to tabulate the full number disposed of, which must be considerable. The public lighting, which had been greatly on the increase of late years, was assuming considerable proportions; the 11,000 lamps in use were equal to the number supplied before the electric light was adopted by the City Council. The increase referred, of course, to the suburbs only. Public lighting, though not very remunerative to the Company, was a great convenience, and assisted very materially in the development of any district in which it was installed. It was therefore always a pleasure to the Directors when they could comply with the Municipal Council's wishes in these matters. The Company always endeavoured, as far as possible, to keep the works up to date, and to adopt the latest methods of gas manufacture. Anticipating a greater demand for gas, the Engineer was now considering plans for another retort-house at Mortlake. Gas would take a deal of beating. It had had many hard knocks, but had always triumphed in the past—a state of things he ventured to hope would be experienced in the future. The increase in the number of public lights during the half year was 101. The number of gas-cookers disposed of by the Company was 16,626. He could not say for a certainty how many gas-engines were in use; but there were a considerable number. It was exceedingly gratifying to him to be able to state that the consumers had increased by 3087 during the six months; the total number on the Company's books at present being 83,148. The length of mains and service pipes laid to date was 2271 miles; being an increase over the previous half year of 44 miles. These additional lengths of main not only represented extensions in new districts, but in the older areas as well, which had necessitated the substitution of much larger pipes for those previously laid.

The report was adopted; and the dividend recommended was agreed to.

The Directors and officers were afterwards thanked for their efficient services to the Company.

WANDSWORTH AND PUTNEY GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday at the Offices, Fairfield Street, Wandsworth—Mr. HENRY E. JONES in the chair.

The Secretary (Mr. Charles W. Braine) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

THE PRICE OF COAL.

The CHAIRMAN, in moving the adoption of the report and accounts, said the half year under review had been noted by the high price of coal, in consideration of which the Company had not, as the leading Companies in the Metropolis had done, raised the price of gas at all. They had faced the emergency without increasing their charge; and some people thought that, this being so, probably when the cost of coal came down, the Company might even conceive such a wild project as making a reduction in the price of gas. Pending, however,

the completion and putting into operation of a new steamer which the Company were now having built for carrying their coals, and which they hoped would result in some economy, the Directors would have to defer consideration of any matter of this kind. In fact, the Board would have to wait until they had realized two things before they thought of reducing the price of gas—namely, what the price of coal was going to be, and how far the anticipated economies to which he had just referred would be actually secured. As to the price of coal, this was, of course, a burning question. Most of them were very well aware that the state of trade in the country—as indicated by the low bank-rate and by the low price of metals—had hardly ever been worse; and he must say that he admired the extraordinary ingenuity and the perfectly good understanding that seemed to exist among the various coalowners—as shown by their managing to secure from the administrators of most of the gas companies a renewal of their contracts during the spring and summer at prices within a shilling or two per ton of what they had obtained before, when trade was busy and good, whereas the coalowners at the present time must have much difficulty in knowing what to do with the coal that was being raised, in face of the great slackness in the iron trade, which was the only great competitor for coal of the gas manufacturers. The iron trade not only consumed a good deal more coal than the gas manufacturers, but unfortunately they used the same sort. The non-sulphurous coal made the best foundry coke, and therefore was most suitable for iron smelting purposes. Certainly, it was a tribute to the extraordinary financial ability and tactics of those who were masters of the coalfields that they had secured such rich contracts from the gas companies in face of the existing prostration of trade and consequent falling off in the general demand. The Wandsworth Company had not yet bought the whole of their coal. There was a very small quantity outstanding which the Directors were not disposed to purchase at anything beyond its real value; and they had so far resisted the blandishments of those gentlemen who were endeavouring to secure such prices as were only warranted when the trade of the country was much better than was the case at the present time.

THE ACCOUNTS FOR THE HALF YEAR.

Now as to the accounts. As compared with the corresponding half of the previous year, the income was something like £3600 better—chiefly made up by the extra sales of gas and the additional income from meter and stove rents. This, of course, ought to have considerably raised the profit of the past six months; but the price of coal and other material had absorbed £6801 more, so that not only had the extra income all gone but something more than £2000 beyond it. Therefore the profit was not greater, but less. Again, the Board had found it desirable—occasion suited—to carry out certain important repairs and alterations to the works, which had caused the expenditure in this way to be something like £1700 more than last year. Of course, they had to do these things not just as they would like, or else they would avoid a period when coal was dear. Such things as alterations to mains and buildings had to be carried out irrespective of the coal owners. So it happened that the profit looked rather meagre. In fact, it did not quite clear the dividend; but it only fell short by a matter of some £1700 or £1800. However, taking into consideration that the charge for gas had been no more than 2s. per 1000 cubic feet, or less with discounts, it would be admitted that the profit realized was really a very satisfactory one indeed; and it did not discourage the Directors from looking forward to the time when they might even sell gas a little cheaper, though they were not just yet in the pleasant position of being able to announce a reduction. The accounts called for little further comment. The working of the Company was extremely good as regarded the make of gas per ton; and the leakage—which was such a vexed question—was quite moderate and reasonable.

THE QUESTION OF LEAKAGE.

Those of the shareholders who read the accounts and the proceedings at the meetings of other gas companies, would have seen that the question of leakage had been disturbing the Metropolitan atmosphere somewhat. One authority declared himself puzzled by a rise of 1 per cent. in this item; while a second stated that there was nothing very irregular in the leakage varying by as much as nearly 4 per cent. between one half year and another. Well, the humble opinion of the Directors of the small Wandsworth Company was that they would have something serious to say to their Engineer (Mr. H. O. Carr) and their Secretary if they showed such a fluctuation as 4 per cent. between one period of six months and another. They would think they ought to keep their books a little more uniformly than this. With regard to the leakage suddenly going up or down materially, those of them who, like Mr. H. S. Freeman and himself, had been long at this job, would tell the shareholders that it was quite impossible for the main-pipes or the structures of the gasholders, the service-pipes or the meters on the district, to alter to the tune of 1 per cent.—much less larger quantities—and that what the solution of most of these problems amounted to was that there had not been produced the quantity of gas that had been taken credit for. The disappearance of so large a bulk of gas would not take place without extensive injury to the distributing system of a company, and could not occur without being apparent. Equally, when a manager thought he had saved 1 or 2 per cent. in leakage in a half year, it would generally be found that he had produced a little more gas than he had given himself credit for, and that he had merely sold the greater quantity so produced. The two factors which were absolute certainties, and which were the only ones worthy of the cognizance of a body of shareholders, were how many tons of coal and oil were used on the one side, and how much gas was paid for on the other. The rest was more or less a matter of imperfect registration, or of still more imperfect human calculation. He did not know that he need take this subject any further. It might not have had interest to the lay mind at all, except that the "Lancet," having observed the remarks of the Chairman of one of the important Companies, had jumped to the conclusion that the population was being poisoned by gas, which they assumed had been escaping out into the streets and houses of London, but which, in his own humble opinion, had never existed at all. It certainly could not have passed out in this way. Returning to the accounts, he might remark that the results from residuals had been fairly good in the period under review; but prices were falling rapidly. Coke especially was going down; so it might be in the future, as the Company were still paying an undue price for coal, that the profits might possibly not come out as high even as on the present occasion.

THE SUBJECT OF RATES AND TAXES.

He was pleased to be able to inform the shareholders that—perhaps owing to the moderate price of gas (and they supplied the public lamps on even cheaper terms, and gave very good attention to the service)—the Company maintained the most excellent relations with the Local Authorities in the district. It was gratifying to be able to state that the rates and taxes were satisfactory. The authorities did not appear to squander the ratepayers' money quite as freely as, to judge by the newspaper accounts, had been done in other parts of London. Fortunately, at Wandsworth the Guardians did not feel that they need give fresh butter and half-crown tea to paupers, and otherwise encourage them to congregate; and they did not, under spurious pleas of philanthropy, wastefully spend the rates that were extorted from struggling tradesmen and others in the district. What was practised in their neighbourhood might perhaps not be a form of philanthropy which would commend itself to the socialistic mind; but the Directors thought there was no more excuse for the existence of extravagance and waste, under the cover of philanthropy, in the administration of the Poor Law, than there would be if the Directors themselves subscribed from the funds of the Comp ny to all sorts of charities, and so got for themselves the reputation of being benevolent at the expense of the gas consumers.

POSITION OF THE UNDERTAKING.

In spite of the low price of gas and the high price of coal, the undertaking was in a thoroughly satisfactory and prosperous condition, which was evidence that the officers had done their best—as they always did—in working zealously in the interests of the Company. The meeting ought to have been held a fortnight earlier; but it was found that, owing to the increase in the business, it would have been necessary in that case to rely upon estimates, whereas both the Board and the officers preferred to state absolute facts. Owing to the consequent delay, the Deputy-Chairman (Mr. T. A. Ives Howell) was not able to be present that day. It was the first meeting that he had missed for many long years.

Mr. H. S. FREEMAN seconded the motion, which was carried.

THE DIVIDEND.

The CHAIRMAN proposed the payment of dividends at the statutory rates of 8 per cent. per annum on the "A" consolidated stock, 6½ per cent. on the "B" consolidated stock, and £5 12s. per cent. per annum on the ordinary "C" stock.

Mr. E. R. RANSOME seconded the motion, which was agreed to.

The CHAIRMAN proposed a hearty vote of thanks to the Secretary and Engineer for their services during the past half year, and brief acknowledgments by Mr. BRAINE and Mr. CARR brought the proceedings to a close.

Gas Workers' Flower Show.—A very successful exhibition of flowers, fruit, and vegetables was held on the 22nd ult. in the Gas Workers' Recreation Room in Devon Street, Saltley. Competition was limited to employees of the Gas Department. The men at the various gas-works took keen interest in the show, and contributed the bulk of the exhibits, one of the most interesting of which was a splendid collection of vegetables—comprising peas, runner beans, cucumbers, celery, parsnips, carrots, and other roots—grown on the gas-works at Swan Village.

Reductions in Price.—The Directors of the Peterborough Gas Company have reduced the price of gas used for lighting from 2s. 9d. to 2s. 8d., and for power (to consumers of 25,000 cubic feet per quarter) from 2s. 5d. to 2s. 4d., per 1000 cubic feet. As from the 21st of June, the price of gas to ordinary consumers at Newark has been reduced from 2s. 8d. to 2s. 6d. per 1000 cubic feet; and a proportionate increase in the quantity of gas supplied to the prepayment consumers will be made as soon as the necessary alterations to the meters can be carried out. The Directors of the Eastbourne Gas Company have decided to reduce the price of gas 2d. per 1000 cubic feet as from the 1st of January next.

Woking Water and Gas Company.—At the meeting of the Company next Monday, the Directors will report that the balance at the credit of the profit and loss account is £5341, out of which the Directors recommend the payment of a dividend at the rate of 5 per cent. per annum for the past half year, less income-tax. This will absorb £3996, and leave £1345 to be carried forward. The Guildford Corporation completed the purchase on the 25th of March last of the saleable portion of the Company's water undertaking within the borough of Guildford; and the obligation of the Company to supply water in the area consequently ceased from that date. During the past half year, 114 additional house and 21 new meter connections were made, and the mains extended about 3213 yards.

Gas Supply in Japan.—The following was among the "Japanese Trade Notes" in a recent number of the "Financial News": "The Nikkan (Japan-Korea) Gas Company has been successfully floated. The new Company has been granted the following privileges: A monopoly for 25 years, all machinery and apparatus to be admitted free of Customs duties, and the lease of 14,000 tsubo of land by the Government at a special moderate rent. The Household Department of Korea will take up 3000 shares, while the Imperial Household of Japan has also decided to subscribe for some. The Company have been ordered to pay each year the 500th part of their net receipts to the persons in charge of streets where gas-pipes are laid, and also to pay to the Government, when the net income exceeds 15 per cent. per annum of the paid-up capital, one-fifth of the balance, after deducting the above rate from the total receipts. Otherwise the Company will be free of public taxation."

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

Increased Prepayment Consumption at Barnsley.

At the annual meeting of the Barnsley Gas Company last Thursday, the accounts presented showed that in the year ending the 30th of June the manufacture of gas cost £15,480, distribution £3315, and management £1032. The income from the sale of gas was £24,150, and from residual products £5699. The total revenue was £30,163, and the total expenditure £22,153; leaving a balance of £8010 to be carried to the profit and loss account. The Directors recommended that, in addition to the interim dividend paid in March, there should be declared a further dividend of 5 per cent. on the general capital stock and "F" shares, 3 per cent. on the "C" (preference) shares, and 3½ per cent. on the "D," "E," and "G" shares, in each case less income-tax. The Chairman (Mr. E. G. Lancaster), in moving the adoption of the accounts, said that on the expenditure side there were one or two items which were rather discouraging, while on the other they had several which were highly satisfactory. Last year he warned the shareholders of the prospect of a very heavy increase in the cost of coal; but their estimate—£2000—had unfortunately proved wrong, the extra amount being £2440. Repairs to mains had cost £257 extra, due to subsidence owing to coal workings. There was a large increase of £603 in repairs to meters, mainly due to the further introduction of prepayment meters. Of the 3000 now in use, 700 had been put in during the year, and they were fixed at the Company's expense. The total increase of expenditure on the production of gas reached £3638. This appeared to be a large amount to deal with; but on the other side they had an increased sale of gas of 8,691,000 cubic feet, producing £1470 extra, following an increase of nearly 4 millions. The revenue from the sale of residuals had been better than had been anticipated. They had a total increase of £2436, against an extra outlay of £3638; so that they were about £1200 to the bad. This sum had been about met by the temporary suspension of the discount formerly allowed to customers; and the net result of the year's working was nearly as good as a year ago. The Company were able to pay the statutory dividends and carry forward about £30. Referring to the increased demand for gas, the Chairman said this was due mainly to the extended use of prepayment meters and the growing popularity of gas for cooking purposes. With regard to the future, the new coal contracts would effect a reduction of from £600 to £700; but on the other side they saw a decline in the residual markets, and he confessed the outlook was not pleasant. There was another serious drawback to the success of the Company in the increasing leakage of gas. This was rather more than 12 per cent., or 5 to 7 per cent. higher than it ought to be, in spite of all their efforts. But it was easily accounted for. The subsidences which were chiefly responsible for this leakage were in the Stairfoot and Ardsley district, where the Oaks Colliery coal lease was coming to an end, and the owners were working back again, with the inevitable result that the whole of the land in the neighbourhood was on the move; and if new mains were put down, they would probably soon be disturbed to a considerable degree. Having got over the extra cost of the coal, the Directors hoped they would be able to present a no less satisfactory balance-sheet next year. The accounts were approved.

Increased Revenue at Bath.

At the meeting of the Bath Gas Company last Wednesday, the Directors reported an increase in the sales of gas and an improvement in the returns for coke in the six months ending the 30th of June. This met to some extent the extra cost of coal, and helped to make the half-yearly statement of accounts as satisfactory as it was. The revenue from the sale of gas amounted to £31,150; the rental of meters, stoves, and fittings came to £3964; the sale of residuals produced £11,919; and the total receipts were £47,206. The principal items of expenditure were: Coal and oil, £18,816; repairs and maintenance of works and plant, £4348; expenses of distribution, £5896; and management, £1689—various other expenses making up a total of £36,286. For the corresponding period of last year the income was £43,979, and the expenditure £32,701. The balance carried to the net revenue account for the past six months was £10,920, compared with £11,278 before. The amount available for distribution was £13,508; and the Directors recommended the declaration of the maximum dividend of 5 per cent. on the consolidated stock, less income-tax.

An All-Round Increase at Blyth.

At the half-yearly meeting of the Blyth and Cowpen Gas Company last Thursday, the Chairman (Mr. W. Thompson) presented the financial statement for the six months ending the 30th of June. The revenue account showed an income of £9680, and the expenditure totalled to £7293; leaving a balance of £2387 to go to the profit and loss account. All the items of income showed increases; the most notable being £851 in the prepayment meters account, and £336 in the coke account. The Chairman said there had been a substantial expenditure on coal, in consequence of increased prices. Out of the balance, it was proposed to pay a dividend on the ordinary stocks, which now stood at £65,704, at the rate of 3 per cent., absorbing £9771, and leaving a balance to the good of £2793. The quantity of gas made during the half year amounted to 50,011,400 cubic feet—an increase of 4,537,000 cubic feet over the corresponding period of 1907. There were 4614 tons of coal carbonized, yielding 10,839 cubic feet of gas per ton. The works and plant were being maintained in a state of efficiency. The whole of the parliamentary area of supply was now covered with mains, and the Company were being encouraged in the expenditure by the large increase of consumers and the success of the prepayment meter system. Negotiations had been completed with the Seaton Delaval Coal Company for permission to lay mains and service-pipes and put installations into workmen's houses at the New Delaval Colliery. In response to a canvass of the district, some 320 householders had expressed a wish to be supplied with gas. The work had been commenced, and it was expected that the whole of the district would be supplied by the end of the year. The accounts were approved.

Increased Sale of Gas at Brighton.

At the half-yearly meeting of the Brighton and Hove Gas Company last Friday, the Directors reported that the sale of gas in the six months ending the 30th of June showed an increase of 17,634,800 cubic feet, or 2·97 per cent., in comparison with the corresponding period of 1907; and that the residuals had produced £1399 more. In order to give effect to an agreement recently concluded with the Corporation of Brighton, the Company replaced during the half year 569 old flat-flame burner lamps by others fitted with improved incandescent burners. The result was a conspicuous success; the lighting of the streets affected being much improved. The accounts accompanying the report showed that the sale of 611,343,400 cubic feet of gas, at prices ranging from 4s. down to 2s. 10d. per 1000 cubic feet, produced a sum of £92,323, and the rental of meters, stoves, and fittings £8077 (making together £100,400); the sale of residuals brought in £19,621; and the total revenue was £120,196. The principal item of expenditure was £45,078 for coal, coke, and oil used in manufacture; and a sum of £10,024 was spent on the repair and maintenance of works and plant. The charges relating to manufacture came to £62,493; distribution cost £19,770; and management, £4849—the total expenses being £93,110. The balance carried to the profit and loss account was £27,086; and the amount available for distribution was £34,617. The Directors recommended dividends at the rates of 10¾ and 7¾ per cent. per annum on the original and "A" ordinary consolidated stocks, and of 6 and 4 per cent. per annum on the "B" and "C" preference consolidated stocks. These payments would amount to £23,069, and leave a balance of £11,548 to be carried forward. The statements relating to the working of the Company in the half year showed that 36,499 tons of coal and 592,049 gallons of enriching oils were employed in the manufacture of gas; the estimated quantities of residuals being: Coke, 22,108 tons; breeze, 1628 tons; tar, 433,990 gallons; ammoniacal liquor, 912,380 gallons.

A Satisfactory Half Year at Chichester.

The address of Mr. Alfred Lass, the Chairman of the City of Chichester Gas Company, in moving the adoption of the Directors' report at the half-yearly meeting of shareholders on Monday last week, gave evidence of satisfactory progress in the six months ending June 30. He said the general result of the Company's working in that period was as follows: The quantity of gas made was 32,428,000 cubic feet, whereas the make in the corresponding half of last year was 31,174,000 cubic feet, or an increase of 1,254,000 cubic feet. The quantity of gas sold was 29 195,700 cubic feet, compared with 27,967,600 cubic feet before—a rise of 1,228,100 cubic feet, or 4·39 per cent. The gas made and sold per ton of coal carbonized was 11,909 and 10,722 cubic feet respectively; being 890 and 836 cubic feet more than in the first half of 1907. Notwithstanding the greater quantity of gas produced, the bulk of coal carbonized was 106 tons less. The income was £7113, and the expenditure £5458; showing a gross profit of £1655. Deducting the income-tax and the interest on the debenture stock and temporary loans, there was left available for distribution £1349. The Directors recommended the declaration of dividends at the rates of 10 and 7 per cent. per annum; but as these would require £1434, it would be necessary to draw upon the undivided balance to the extent of £85. During the half year there had been an increase of 67 meters and 57 cooking and heating stoves on hire; while the number of new services laid for consumers amounted to 93. The Company's mains had been extended to New Fishbourne—a portion of their district not hitherto supplied with gas; and 17 ordinary and prepayment meters and 13 cooking and heating stoves were fixed there. In conclusion, the Chairman expressed the gratification of himself and his colleagues that the relations between them and the staff and employees were of an exceedingly amicable character. The Directors believed that the efforts put forth for the general welfare of the employees, as well as for that of their wives and children, were thoroughly appreciated. Mr. W. A. Walker, in seconding the motion, made special reference to the excellence of the carbonizing results; and Mr. Joseph Cash in supporting it, paid a very warm tribute to the management. Referring to the amount of unaccounted-for gas (2,721,200 cubic feet), he remarked that modern traffic on the roads was not conducive to a reduction of this item. Much of the loss was, however, attributable to the difference in the temperature of the gas at the works and at the point of delivery. In reply, the Chairman said that there was not the slightest doubt that a great deal of what was put down as leakage was due to the difference in temperature, as suggested by Mr. Cash; and the Engineer and all concerned were paying very serious attention to the matter. He pointed out that the percentage of unaccounted-for gas was now 8·39, whereas a few years ago it was 10·25. The report was adopted, and the dividends recommended were sanctioned. A vote of thanks having been accorded to the Engineer (Mr. T. Ebenezer Pye, F.C.S.), the Secretary (Mr. Victor V. Vick), and the other members of the staff, for their assiduity in attending to the affairs of the Company, Mr. Pye and Mr. Vick acknowledged the vote; the former remarking that the reason they were able to work together under such happy conditions was because of the assistance they received from the Board. A vote of thanks to the Directors closed the proceedings.

Prospective Reduction at Eastbourne.

The welcome announcement was made by Dr. G. A. Jeffery, J.P., the Chairman of the Eastbourne Gas Company, at the half-yearly meeting last week, that the Board are of opinion that circumstances will enable them to reduce the price of gas from 2s. 8d. to 2s. 6d. per 1000 cubic feet. The report which was adopted stated that the revenue account showed a profit for the half year to June 30 of £8119; while there was a balance of £17,274 at the credit of profit and loss account after payment of the half-yearly dividend in December last and other charges. The Directors recommended a dividend for the past six months at the rate of 15 per cent. per annum on the original capital and "C" shares, and 12 per cent. per annum on the "B" shares, This would absorb the sum of £8077, and leave a balance of £9197 to be carried forward. Referring to the report, the Chairman said the figures were satisfactory, and pointed to the continued progress and prosperity of the Company. The sale of gas had increased from 196 million cubic feet to 209 millions—an increase of nearly 7 per cent., as compared with a 5½ per cent. increase in the previous year. The

number of consumers was now 4471 ordinary and 4267 coin-meter, together 8738, a gain of 348. The leakage was again higher than the Board thought it ought to be; and the matter would be gone into. The net profit was £8119, against £8475. This was sufficient for the proposed dividends, after most liberal provision had been made in respect of repairs and depreciation. Coals and gas-making materials had cost £16,368, against £13,588, an addition of £2780; coal having cost 17s. 5d. per ton, as against 15s. 11½d. Residuals had produced £8113, against £6794, a gain of £1319. The net expenditure for coals and oil had been £8255, against £6795, an increase of £1460. The receipts for gas and rents of meters and stoves, &c., were £31,139, against £29,115, a gain of £2024. The Directors did as much as they could for the shareholders; but they did not forget the consumers. They had this year enlarged the scale of discounts to consumers of large quantities of gas. When an annual account amounted to £40, the discount would now be 2½ per cent.; £100, 5 per cent.; £150, 6¼ per cent.; and £200, 7½ per cent. The special discounts of 10 per cent. and 1¼ per cent. to users of gas-engines would be allowed in addition to those mentioned. So that a gas consumer whose account amounted to £200 per annum, and who used a gas-engine, received a discount off gas used in the latter of 18¾ per cent. In other words, he obtained his gas for power at 2s. per 1000 cubic feet. The meeting passed a resolution increasing the salary of the Secretary (Mr. J. S. Garrard) from £450 to £500 a year, free of income-tax, as from April 1 last. In acknowledgment, Mr. Garrard referred to the assistance he received from the officials—especially Mr. John Hammond, the Resident Engineer and Manager. Replying to a vote of thanks to the officials, Mr. H. E. Jones, the Consulting Engineer to the Company, spoke of the high position held by the Company, and of the extremely low price at which they supplied gas to the consumers. The Company's enviable prosperity was due largely, he said, to the broad far-sighted spirit in which the Directors had provided for the development of the undertaking on sound, up-to-date lines. They had not been afraid to face difficulties when they arose, nor had they hesitated to spend money freely when the legitimate interests of the Company demanded it, and there was a promise and prospect of getting a return for the outlay.

A Successful Year at Hartlepool.

The annual meeting of the Hartlepool Gas and Water Company was held last Friday—Mr. T. Appleby presiding. The Directors in their report stated that the revenue for the year was £93,851, and the expenditure £61,345; leaving a profit of £32,506. They recommended the payment of a dividend for the last half year at the rate of 5 per cent. per annum, less income-tax. They added that the sales of both gas and water had increased. The Chairman, in moving the adoption of the report, congratulated the shareholders on having had another successful year, which had enabled the Directors to declare the maximum dividend, and carry forward a balance of £582. Considering the great depression in all branches of trade during the year, he thought this result was most satisfactory. A year ago he had great doubt as to what the result might be. An increased cost for coal and oil, amounting to nearly £7000, then faced the Company; but the Directors hoped that, by great economy in the management and an increased revenue from the sale of residuals, it might be possible to tide over the difficulty without having recourse to raising the price of gas. He was glad to say this had been accomplished; but the difficulty had not been overcome without considerable anxiety on the part of both Directors and management. There had been an increased revenue derived from the sale of coke of more than £3000, and from the sale of water of £833; and over the year there had been a decrease of £2000 in expenditure for repairs and maintenance of the gas works and plant. There could be no doubt that gas as an illuminating agent was vastly superior to, and cheaper than, any other system of artificial lighting. The public were quickly coming to this conclusion; and consequently the Directors looked forward with confidence to the future of gas companies. The prepayment meter department continued to make steady progress—150 new consumers having been added during the year; making a total of upwards of 7200. It was hoped that still further progress would be made in this direction, for in the home of the artisan gas was unequalled for the comfort and economy it afforded. The tar market was in a very weak condition, and the revenue from this residual showed a further decline of £226. He was, moreover, afraid that they had not yet reached the bottom. There was, however, a limit to these reductions in price; and it might be found necessary in the near future to do what had been done in the past—viz., burn the tar as fuel in place of coke for heating the retorts. If gas companies were united on this point, much might be done in clearing the market of surplus tar, which now tended to reduce the value. The results of the disposal of sulphate of ammonia were slightly above those of last year, which were good. They were dependent, however, very largely upon foreign demand for the maintenance of the price; and he regretted that just now there were signs of this demand falling off. If it did so to any material extent, they would probably have to accept a lower price for their sulphate. One gratifying feature in this part of their business was the increased local consumption; and if the farmers in the locality would still further extend the use of sulphate of ammonia on scientific lines, he was perfectly sure it would be to their benefit. The Directors had thought it prudent, in face of the falling market, to only partially cover their requirements in coal over this year, and they hoped to have an opportunity later of purchasing further supplies at lower prices. What they had already contracted for had been placed at an average of 2s. 9d. per ton less than the price paid last year. Mr. John Brown seconded the motion; and it was carried.

Improved Carbonizing Plant at Newark.

In the report presented at the 76th annual meeting of the Newark Gas Company, the Directors stated that they had for some time been aware that the retort-bench, containing 84 mouthpieces, in the old retort-house, required renewal; and they mentioned that the cost would exceed £1200. On the advice of their Consulting Engineer (Sir George Livesey), however, they had accepted a tender from Messrs. Newton, Chambers, and Co., Limited, for the first half of the work, and it was nearly completed; but next year the remainder would have to be undertaken. The quantity of coal carbonized in the twelve months ending the 30th of June was 9200 tons (an increase of 234 tons compared with the preceding year); and it produced 90,595,400 cubic feet of gas, of which 84,960,100 cubic feet were sold—being 2,441,000 cubic feet more than before. The unaccounted-for gas has been reduced to about 6 per cent. of the entire make. The revenue for the year was £16,006, and the expenditure £12,915; leaving a balance of £3091. An interim dividend at the usual rate was paid in March; and the Directors recommended the declaration of final dividends (less income-tax) at the rates of 10¾, 5, and 7¾ per cent. per annum on the "A," "B," and new ordinary shares respectively.

Water.

Further Powers for the South Staffordshire Company.

The report and accounts presented at the half-yearly meeting of the South Staffordshire Water Company last Wednesday showed that the number of houses connected in the six months ending the 30th of June was 1007, bringing up the total to 134,765; and that the water-rates amounted to £71,955, compared with £70,117 in the corresponding period of 1907. The amount available for distribution was £30,239; and the Directors recommended the declaration of a dividend at the rate of 7 per cent. per annum, less income-tax. As this would amount to £22,475, there would remain a balance of £7764 to be carried forward. The Engineer (Mr. H. Ashton Hill, M.Inst.C.E.) reported that the buildings, machinery, and plant were all in substantial order and repair. In moving the adoption of the report, the Chairman (Mr. C. G. Beale) said the accounts did not present any features that required explanation. Taking the capital account first, they had spent a smaller amount than in any half year for a long time. But this must not be taken to indicate that capital outlay was gradually stopping. It was rather accidental than otherwise, because they must always go on increasing their expenditure so long as the demand for more water continued. The revenue account, with the exception of two items appearing on the debit side, bore much the same aspect as last year. As regarded receipts, the increase was not so large as they had been accustomed to. The demand for water had not augmented so rapidly as in the past, owing principally to the bad condition of the building trade. Still, they had proposed the same dividend and carried forward the same amount. There was one subject to which the attention of the shareholders ought to be called. He had referred before to the necessity of looking out continually for improved means of supply so long as the district showed signs of increasing; but the situation had changed considerably during the last few months. Under their Act of 1893, they acquired certain powers, which they had acted upon, to purchase sites by agreement and erect pumping-stations, assuming that the section under which they acted gave them full power to do so. But in the South of England a Company had got into litigation, which raised the question whether water companies had any right to sink a well because they had been authorized to buy land by agreement. The case came before one of the Judges in the Chancery Division, who decided that the Company in question were acting *ultra vires*. They appealed; but they met with short shrift at the hands of the Lords Justices, who upheld the decision of the Judge in the Court below.* So that, whereas they had believed they had a perfect right to establish pumping-stations on sites they had acquired by agreement, it turned out that they had not. In this respect, they were not alone. The South Staffordshire Company had received complaints of having damaged water supplies. They must therefore set their house in order by going to Parliament to have confirmed everything they had done in the past. He did not anticipate the least difficulty in doing this, and had no doubt they would get their Bill through. But it would be neces ary to ask the shareholders to sanction the promotion of a Bill. Mr. F. H. Lloyd seconded the motion; and it was carried.

Extensions of Mains and Plant at East Worcestershire.

The Right Hon. the Earl of Plymouth presided on Thursday at the half-yearly meeting of the East Worcestershire Water Company. The report of the Directors showed that during the half year ended June 30 last 93 additional services were laid on; making the total 7400, exclusive of the districts supplied in bulk. The average daily consumption of water had been 1,185 500 gallons. A short extension of the mains had been made to Staple Hill, in the North Bromsgrove district, the cost of which, with some additions to the plant, was added to the capital expenditure. The net profit was £2362, which, added to the balance brought forward from last account, showed a disposable sum of £3446. This it was proposed to appropriate as follows: To pay a dividend for the half year at the rate of 5 per cent. per annum, free of income-tax, £1831; to provide for depreciation on buildings £100, and on machinery and mains £600; and to carry forward the balance, £915. The Directors added that, in order to improve the supply available at the Burcot pumping-station, it was decided to connect the old well with No. 2 borehole. This work had been successfully completed since the accounts had been made up, and had fully justified the expenditure, which would amount to about £180. The Chairman, in moving the adoption of the report and accounts, explained, in reference to the increased cost of maintenance, that the pumping and engine-house expenses, including the cost of coal, wages, &c., accounted for £1217. In the preceding half year, the amount spent in respect of the pumping and engine-house was £1008, so that £209 of the total of £2556 incurred for maintenance charges represented the increased price of coal. The balance carried forward now was rather less than at the close of the preceding six months, when the amount was £1084; but the difference was not very great. The additional quantity of water available at the Burcot pumping-station, in consequence of the connection of the old well with No. 2 borehole, was 250,000 gallons per 24 hours, and it had been secured for £180. He thought this expenditure had been amply justified. Mr. C. P. Noel seconded the motion. Mr. H. Ashton Hill asked how long the Directors proposed to continue setting aside £700 a year for depreciation. He also asked to be informed as to the total expenditure on capital

* The case referred to was reported in the "JOURNAL" a short time ago (see Vol. CI., pp. 636, 843) —ED. J.G.L.

account, and remarked in regard to the provision for depreciation that it was possible to be over-safe, and to do an injustice to the present shareholders. The Chairman, in reply, said the view of the Directors was that it was right to take into consideration the necessity for renewals of mains and machinery. The question had been very carefully looked into, and it was thought advisable that the amount stated should be set aside for depreciation. The Secretary (Mr. P. W. Walker) explained that the capital expenditure account showed a very large unproductive sum which did not yield any profit. In addition to renewals, mains had sometimes to be duplicated; and recently a sum of £4000 had been spent for this purpose. The Directors desired to be always beforehand, in order to be able to meet the requirements of the district. The total capital expenditure of the Company had been £91,000. The report was adopted.

ZURICH GAS SUPPLY.

Report of the Gas Undertaking for the Year 1907.

We have received from Herr Weiss, the Engineer of the Zurich Corporation Gas-Works, a copy of the report for last year, from which we give, as in previous years, the following particulars which are of general interest.

The extension of the works' plant, which had been put in hand in 1906, was completed during the past year. The new gasholder of 50,000 cubic metres (1,765,000 cubic feet) capacity was brought into use on Sept. 30; and the installation of Bueb vertical retorts, towards the end of November. A pumping station for works' water and experimental gas-making plant were also finished. Other work which is to be carried out during the current year comprises new coke breaking and sorting plant, and the roofing-over of various sidings, pipe conduits, and heating and electrical installations. A third works' locomotive is on order, which when delivered will displace one which has proved too small for present needs. A new 24-inch main, 3500 feet in length, was laid to connect the two existing trunk mains leading to the town, with a view to securing greater uniformity of pressure and distributing capacity. A main and public lamps were extended towards the Uetliberg—a favourite hill resort near Zurich. The automatic lighting and extinguishing appliances for street-lamps were increased in number by 78—making a total in use on Dec. 31 last of 1315. There were then 6024 public lamps, with 7474 burners, of which all but 50 were of the incandescent type.

The gas made amounted to 26,412,800 cubic metres (932,810,000 cubic feet), which represents an increase of 13·14 per cent. on the make in 1906. The increases in the three preceding years have been at the rates of 9·45, 8·40, and 10·50 per cent.; so that 1907 is marked by a considerable advance as compared with earlier years. There were carbonized 85,640 metric tons of coal, and 1384 metric tons of cannel; and the average make of gas was 10,891 cubic feet per English ton, or about 90 cubic feet more than in 1906. Great difficulty was experienced in obtaining delivery of coal; and considerably more English coal was used, in consequence of the falling off in the supplies from the German pits. The coal was, moreover, frequently very inferior in quality, and more costly than in the preceding year. The unaccounted-for gas amounted to 4·89 per cent. of the make, as compared with 4·36 per cent. in 1906. Of the make 55·84 per cent. was sold for cooking and heating purposes; 17·67 per cent. to ordinary consumers for lighting; 9·07 per cent. was used in public lighting; and 3·65 per cent. was sold in places lying outside the town boundary. The amount of gas sold for cooking and heating was 14·1 per cent. more than in the preceding year.

The yields of bye-products (stated in percentages of the weight of coal carbonized) are shown below, alongside those obtained the previous year:—

	1907.		1906.
Coke	70·106	..	73·367
Real ammonia	0·2063	..	0·1975
Tar	6·260	..	6·318
Thick tar (pitch)	0·237	..	0·366
Producer clinker	4·150	..	3·680
Retort-scurf	0·060	..	0·093
Prussian blue	0·1155	..	0·0829

A large number of analyses of these products, and of the coals used and the furnace gases, oxide of iron, &c., on the works, were made in the laboratory. The average net calorific value of the gas made was 552 B.Th.U. per cubic foot at 60° Fahr. and 30 inches, calculated for gas in the dry state. Its illuminating power when burnt in a slit-burner at the rate of 5·3 cubic feet per hour averaged 11 hefners (= 10 candles). Only a part of the gas was passed through washers for the extraction of naphthalene and cyanogen. The gas distributed contained on the average: Naphthalene, 1·966 grains per 100 cubic feet; cyanogen, 5·746 grains; ammonia, 0·029 grains. The amount of sulphur in the purified gas from the German coal was about 17½ grains per 100 cubic feet, whereas it was more than twice as much in the gas from English coals.

The net profit realized on the year's working was 1,001,245 francs (= about £40,050), which is 49,598 francs, or £1984 more than the profit for 1906.

Death through Inhaling Coal Gas.—Charles Jones, a widower, 82 years of age, was recently found dead in his bedroom in the house of his grandson, the landlord of a public-house at Norwich, with whom he was staying. On retiring to bed on the preceding night, deceased was told by his grandson that he might leave the gas, which was supplied through a prepayment meter, burning all night or turn it out, as he thought proper. When the grandson rose next morning, he found that the gas had given out. On proceeding to his grandfather's bedroom, he was met with a strong smell of gas, and saw deceased lying on the floor alongside the bed. The gas-tap was turned half-way on. At the inquest, a medical man stated that he was called in and found deceased dead, and that everything pointed to the fact that he had died from gas poisoning. A verdict of "Accidental death" was returned.

BLACKBURN CORPORATION GAS SUPPLY.

The Past Year's Working.

The accounts of the Blackburn Gas Department for the year to March 25 have just been issued by the Borough Treasurer (Mr. J. H. Bailey). They show that the net revenue from the sale of gas was £97,075, and from the sale of residual products £21,248; the total income being £121,956. The expenditure on the manufacture of gas was £59,066, of which £42,716 was for coal, cannel, and oil, £7414 for wages, and £7565 for the repair and maintenance of works; on distribution, £6675; and on management, £1809—the total expenses being £80,215. The balance carried to the net revenue account is £41,741. For the year ending March 25, 1907, the figures were: Income, £116,892; expenditure, £75,272; gross profit, £41,620. The above-named balance is disposed of as follows: Interest on stock and mortgages, £21,528; bank interest, £400; transferred to loans fund for the extinction of stock and to the sinking fund, £10,612; carried to the reserve fund, £9201—total £41,741. The balance standing to the credit of this fund at the end of the preceding financial year was £1643; and the present addition brought up the total to £10,844. As, however, a sum of £17,017 has been spent—£1914 on prepayment meters, £9102 on a retort-bench, £2700 on a coke-conveyor, £1106 on a tar-extractor and washer, and £1211 on condensers—the account has been overdrawn to the extent of £6173.

The working statement following the accounts shows that the quantity of coal and cannel carbonized was 49,927 tons, and oil equivalent to 16,932 tons was used; making a total of 66,859 tons of raw material. The gas made was 720,332,000 cubic feet, of which 466,076,100 cubic feet were sold to private consumers (including gas for cookers and engines), 166,458,475 cubic feet through prepayment meters, 34,737,425 cubic feet for public lighting, and 7,806,500 cubic feet were used on the works; making altogether 675,078,500 cubic feet, and leaving 45,253,500 cubic feet, or 6 3 per cent. unaccounted for. The gas made per ton of coal was 10,773 cubic feet, and the quantity sold 9980 cubic feet, or 92·63 per cent. of the make. The quantity of coke made was 33,619 tons, of which 5206 tons were used as fuel. The tar made was 674,200 gallons, or 13·50 gallons per ton of coal; the sulphate of ammonia, 478 tons, or 21·4 lbs. per ton. The total expenses (less residuals) came to 17s. 0·30d. per ton of coal and 1s. 8·47d. per 1000 cubic feet of gas sold. The total rental and the public lighting, worked out on the same basis, came to 29s. 0·46d. and 2s. 10·91d.; so that the gross profit was 12s. 0·16d. and 1s. 2·44d.

It must be gratifying to the Engineer and Manager (Mr. S. R. Ogden) to find a continually augmenting demand for gas; the June quarter of the present year showing, as it does, 6·5 per cent. increase through consumers' meters.

RHYL GAS UNDERTAKING.

Extensions at the Works.

A Special Meeting of the Rhyl Urban District Council was held last Tuesday, for the purpose of considering a proposal by the Gas Committee that £4290 should be borrowed for providing additional plant, mains, and services. The amount included the provision of a new gasholder at a cost of £2200, £165 for exhausters, and £700 for new mains on the West Parade. Mr. Perks, the Chairman of the Gas Committee, in asking the Council to sanction the loan, said he was thoroughly satisfied that the recommendations of the Gas Engineer (Mr. Leonard G. Hall) ought to be carried out. The gas undertaking had been a very profitable one to the town, and it was time the consumers should receive some direct benefit. Assuming that the loan would be granted for 25 years, the cost would only work out at about £270 yearly. Mr. Tilby protested against the idea that consumers should receive direct benefit from the profits made by the gas undertaking. The Council had pledged the credit of the ratepayers in connection with its concerns, and they should, as ratepayers, receive what benefit there was, or suffer any loss that might occur. He did not consider that a new gasholder was of urgent necessity, inasmuch as there had never been any difficulty with regard to the gas supply. He therefore asked the Council to pause before sanctioning the loan. He moved, as an amendment, that the question of a new gasholder be deferred. Mr. Rhydwen Jones, in seconding, said he did so to keep down the town's liabilities. The Gas Engineer explained that additional storage capacity was required to give them a safe balance. A new gasholder would save about £50 a year in wages, fuel, and wear and tear, and, moreover, it must be remembered that their output of gas was steadily increasing. Mr. Frimston was convinced as to the necessity of the holder, and said that if the Council had any confidence in their Engineer and Mr. Perks, as he had, they would have no hesitation in sanctioning the loan. The amendment was defeated by a majority of two, as was also another amendment to omit £211 for contingencies. The Committee's recommendations were then agreed to.

COVENTRY WATER SUPPLY.

Completion of the Shustoke-Coundon Service.

Arrangements are in active preparation by the Coventry City Council for the formal inauguration this month of the new supply of water to the city from the Shustoke reservoir of the Birmingham Corporation. The agreement between the two bodies received the sanction of Parliament in the session of 1907.

The water supply of Coventry is at present chiefly drawn, as it has been since the inauguration of a general service in 1847, from wells at Spon End, which receive the rainfall of the valley below Corley and the higher parts of Allesley. The Spon End works cost only £23,000,

and have long been paid for. About a dozen years ago, the city began to get water from Whitley, on the south-east side, where wells had been sunk; but it is a small supply, and not equal to keeping pace with the demand created by an increasing population. The Council's duties in regard to water were further increased by an extension of the city boundaries in 1899; and though they purchased the mains from the North Warwickshire Water Company, who had rights over the area, no water powers were acquired. When it was felt that fresh supplies must be obtained, Mr. Charles Hawksley went over a good deal of the country round Coventry with a view to fresh wells being sunk; and negotiations were entered into with Lord Leigh for making borings at Weston-under-Wetherley. This project, however, was abandoned when it was found possible for the city to get a supply from Shustoke, and that the only new work requisite to bring the water to local houses and factories was the laying of a main between the two points. The pipes, which run for a distance of 12 miles from the Whitacre pumping-station to the Coundon reservoirs, pass through Maxstoke (where the Meriden Rural District Council may take off a water supply at two places if they think fit), alongside Packington Park into the village, and thence along the Coventry Road through Allesley. There the main goes across fields on the left hand, and so reaches the reservoirs. At Whitacre the main is 239 feet above sea level; while on Meriden Hill its altitude is 494 feet. Between the two points the pipes are 20 inches in diameter; and from Meriden to Coundon, 16 inches. The water, after leaving the Shustoke reservoir, passes through the Whitacre filter-beds, which have been newly-laid. The Birmingham Corporation are required, by the agreement, to maintain the Shustoke supply at a high standard of purity; and if the quality should become unsatisfactory, Coventry is to have Welsh water instead. It is proposed to take at first a minimum quantity of 840,000 gallons per day at the agreed price of 4d. per 1000 gallons; but Coventry may, if necessary, draw on the source for a maximum of 2 million gallons daily. The cost of the scheme is £81,000; but this includes £28,875 for the construction of a new covered tank at Coundon, which at present is not being built. The Shustoke supply gives Coventry an abundance of water without the heavy expense of, and the delay which would be necessitated by, works of construction. The agreement with Birmingham is for sixty years; and it is thought the existing supplies, including that from Shustoke, will provide for a population of 150,000.

WATER SCHEME FOR HOLSWORTHY (DEVON).

Alleged Attempted Bribery of an Official.

The question of the need of an adequate supply of water for the little Devonshire town of Holsworthy has lately been occupying the attention of the ratepayers and their representatives on the District Council; and, according to the "Devon and Exeter Gazette," a very unpleasant incident occurred in connection with their deliberations as to the best way of meeting the requirements of the district. It appears that two schemes were put forward—one by the District Council, and the other by a private Company represented by Mr. Preston, whose name will doubtless be remembered by our readers in connection with the Ticehurst, Selsey, Bude, and other gas undertakings. A largely attended public meeting was held to obtain the views of the ratepayers on the subject; and it was resolved to have a post-card poll of the town. No immediate step was, however, taken to carry the resolution into effect; and consequently the inhabitants have been occupying themselves in weighing the merits of the two schemes. This was the position of things when the Council held their monthly meeting on the 11th ult., under the presidency of Mr. L. Harris. The deliberations of this body are usually very quiet; but on the occasion in question there was a disturbing element, the nature of which will be gathered from the following epitome of the proceedings as reported in our contemporary.

The meeting opened with the reading by the Clerk (Mr. W. C. R. Peterson) of a letter from the Local Government Board, in which it was stated that they had had under consideration the report for the year 1907 of the district Medical Officer of Health (Dr. Gray), in which reference was made to the periodically recurring scarcity of water in Holsworthy; and hope was expressed that the scheme for which they had sanctioned the borrowing of £4700 by the Council would be carried out without delay. The Board desired to be informed what steps had so far been taken in the matter. At this point, Mr. Avery obtained permission of the Chairman to make a statement. He said that on Friday, the 7th ult., there were whispers about the town that certain individuals had been promised sums of money by Mr. Preston if they would use their influence to induce the Council to hand over their water scheme for him to construct works and convey water to Holsworthy. At first, he (Mr. Avery) could not credit the rumours; but he subsequently learnt from another member of the Council (Mr. Parsons) that the Clerk had told him that he had been offered 100 guineas by Mr. Preston with the object mentioned. This statement, said Mr. Avery, was confirmed by the Clerk himself at an interview which he (the speaker) and Mr. Parsons had with him. Subsequently, Mr. Higgs, a member of the Council who had supported the Company's case at the ratepayers' meeting, was apprised of this fact, and Mr. Preston was communicated with on the subject; but up to the day of the Council meeting no reply had been received from him.

Mr. Avery's statement having been corroborated by Mr. Parsons (who, however, thought the matter should not have been brought before the Council, but referred to a Committee), the Clerk, replying to Mr. Avery, said it was news to him that Mr. Preston or anybody else had said anything about inducing the Council to do anything for the 100 guineas. This had never been put to him before. The suggestion of a bribe was entirely Mr. Avery's view of the matter. Mr. Preston certainly mentioned 100 guineas to him; and when he replied, "Of course, I could not accept anything without the consent of the Council," Mr. Preston said it would be in respect of work. He denied emphatically that he had ever been offered a bribe, and he declared that he would bring an action against anyone who asserted that he had. The Chairman (interposing) said the Clerk had told him that Mr. Preston had said: "It will be worth 100 guineas to have the water brought in." The Council could put their own construction on this. He pointed out that there was no resolution before the meeting.

Mr. Parsons said that, after consideration, he was opposed to any further delay in the matter of the scheme. He therefore moved—"That the Council, having made all investigations possible respecting the two water supply schemes that have occupied attention recently, have decided to press forward, as quickly as possible, the Council or Eastacombe scheme." Mr. Harris seconded. Mr. Avery proposed, as an amendment, that the question be deferred to the next meeting, as this would give Mr. Preston an opportunity of replying to the "nasty things" which had been said about him. Mr. Jollow seconded the amendment. He remarked that it had been publicly decided that the ratepayers should vote on the matter, and the Council could not take it out of their hands. The Chairman said he had consistently opposed the idea of a company bringing in the water, and he was unwilling to tie the town up for all time to anybody. He thought the post-card poll would cause unnecessary delay, and believed a large section of the public expected the Council to settle the matter at that meeting.

Mr. Slee pointed out that the matter referring to Mr. Preston had not been cleared up. Mr. Parsons said he took it that Mr. Preston had greatly prejudiced his own case, and had ruled himself out of Court. The people who would have voted for him would not do so now. Mr. Jollow thought Mr. Preston should have an opportunity of refuting the charge brought against him; and Mr. Avery considered that the matter should stand over until then.

At this point the Chairman called for a vote, and the numbers were equal. He then gave his casting vote in favour of the motion for carrying out the Council's scheme. It was afterwards decided that Mr. Chadwick, the Engineer, should be requested to have an interview with the Council at the earliest possible moment; and that the Local Government Board should be informed that the Council intend to go on with their scheme at once.

A special meeting of the Council was held last week to decide the question of the construction of the new reservoir. The plans of the Engineer showed alternative schemes, including one for a reservoir to hold 2 million gallons. After some discussion, a resolution was passed in favour of a reservoir with a capacity of 1½ million gallons; and it was decided that tenders should be invited for the work, and the landowners' terms for the necessary land accepted.

NOTES FROM SCOTLAND.

From Our Own Correspondent. *Saturday.*

An editorial note published in the "Perthshire Constitutional" states that "as a set-off to the increase of a penny-farthing in the ordinary burgh rates, gas consumers are to enjoy a reduction in the price of gas to the extent of 1d., a reduction which is to be shared by those who use gas for manufacturing purposes; while for power purposes the price is to range from 2s. 6d. down to 1s., according to the quantity of gas consumed. This will be considered perfectly satisfactory. It is noteworthy that not a single reference was made (in the Town Council) to irregularities in the gas accounts, as hinted at a former meeting. Are we to understand that the Auditor accepted the explanations offered, and withdrew the reproach? Meanwhile, Councillor Hamilton is entitled to the thanks of the community for the excellent work which he is doing as Gas Convener; and Mr. M'Lusky, the Manager and Engineer, to congratulations upon the completion of another year." A better account of what took place in the Town Council than I was able to give last week states that Councillor Hamilton, in submitting the accounts, said that they estimated a sale of 206,791,000 cubic feet of gas, and they sold 205,331,500 feet. In the previous year the quantity sold was 202,823,000 cubic feet; so that they had an increase of 2,508,500 feet. They estimated a revenue from the sale of gas of £31,189, and the actual revenue was £31,756. The yield of residual products continued to improve, and during the year better prices were received, which together had resulted in a large increase in revenue from these sources. The yield of coke for sale amounted to 10,943 tons, an increase of 501 tons. The yield of tar was 280,808 gallons, an increase of 24,268 gallons; and the yield of sulphate of ammonia was 292 tons, an increase of 40 tons. The money value of the residual products sold was £8350, an increase of £1437. The total receipts from residuals per ton of coal carbonized were 7s. 10·97d., an increase of 1s. 4·34d. The quantity of coal carbonized was 21,103 tons, an increase of 36 tons. The gas made was 212,629,500 cubic feet, an increase of 2,368,500 feet. The yield of gas per ton of coal was 10,076 cubic feet, an increase of 96 cubic feet per ton. The cost of coal per ton was 12s. 1·82d., an increase of 1s. 5·69d. Gas lost by leakage, condensation, and otherwise, amounted to 2·57 per cent. of the total manufacture, a decrease of 0·15 per cent. Consumers by ordinary meters increased from 6490 to 6510, an increase of 20. Consumers by prepayment meters increased from 3948 to 4107. The total number of consumers at the end of the year was 10,617, an increase of 179. The consumption per consumer, excluding the public lamps, &c., amounted to 18,252 cubic feet, a decrease of 131 cubic feet. The number of stoves in use at the end of the year was 8197, an increase of 894. The increase in stoves capital account, in respect of stoves and fittings, amounted to only £151; the bulk of the work having been paid for from revenue. They had been able to write off from the stoves account, out of revenue, £1038, and also £900 from Parliamentary Bills expenses (1871 to 1899). During the year there was expended on capital account £3837 on new purifiers, £171 on new washers, and £662 on new railway sidings, weighbridge, and retort-house equipment. On extensions of mains there was expended £254; on meters, £1257; on the new Provisional Order, £130; and on new stoves, £634, less £433 for hire-purchase rents and sales and £51 for stoves worn out. The stoves capital account had been reduced from £11,054 to £9545. As stated last week, the accounts were adopted.

Speaking at a meeting of the Gourock Town Council on Thursday, Treasurer Johnston said there was an increase in the arrears of assess-

ment, which was readily explained by dull trade. On the other hand, a satisfactory feature in the burgh accounts was the financial position of the gas-works. There had been a great deal of discussion upon the subject of municipal trading; but he thought it was a good thing for a town to own its gas-works. On the gas account they had a surplus of £846. The Council agreed to reduce the price of gas by 2d., making it 3s. 2d. per 1000 cubic feet.

The Banff Gaslight Company had last year a make of 9¾ million cubic feet, and a sale of 8½ millions, an increase of ¾ million cubic feet. Dividends at the rate of 4½ per cent. on the new, and 5 per cent. on the old capital have been paid. Last winter every retort in the works was in use; and at present the Manager (Mr. W. Marshall) is having the retort-house extended by the erection of a new setting of five retorts. Last winter, in order to be prepared for any possible breakdown in the retort-house, Mr. Marshall fitted up an improvised oil-gas plant, consisting of a vertical iron retort, into which oil was sprayed from the top, and the firing of which was accomplished by means of an encasing furnace constructed of two discarded steam-boilers from fishing-boats, placed one on top of the other. The apparatus worked without a hitch. Comment is frequently made regarding the ingenuity of gas managers in coping with suddenly developing difficulties; and this was a notable example of such a situation and its successful negotiation.

On the evening of Friday of last week H.M.S. *Rattler* was commissioned by the Marquis of Graham, with a crew of fifty men of the volunteer service from Glasgow, for a week-end cruise from Greenock to the Isle of Man. The vessel sailed at 9 p.m., and arrived at Douglas on Saturday morning. Greenock was reached on the return run on Sunday evening. That which makes the voyage worthy of being chronicled here is the fact that the vessel was propelled by engines worked by suction gas. The intimation is made that this was the first time that a long trip had been attempted with a vessel propelled by suction-gas engines of high power; and that the result had exceeded the highest expectations for the reliability of the engines in a seaway, also for the small consumption of coal and for other economies. It is added that in connection with the working of the machinery much valuable data had been obtained by Mr. May, of Messrs. W. Beardmore and Co., of Dalmuir, who fitted the engines. A well-written article, by Mr. Frank Kennedy, upon the prospects of the marine gas-engine, was published in the "Glasgow Herald" of last Tuesday.

The Association of Burgh Officials of Scotland held their autumn conference at Ayr yesterday, when among other papers read was one by Mr. D. M'Jerrow, Town Clerk of Lockerbie, upon the administration of the Burghs Gas Supply (Scotland) Act of 1876. Mr. M'Jerrow narrated the experiences of Lockerbie, under the Act, in much the same way that the subject was dealt with by Mr. R. W. Cowie, the Gas Manager at Lockerbie, in the paper he read before the North British Association of Gas Managers last July. He concluded that the illustration showed how the toughest problems of gas administration might arise in small as well as in large burghs, and how carefully, for the small burghs at least, the adoption of the Act should be weighed, thrashed out in its various aspects, and pondered over before a final and irrevocable decision was made. It will be remembered that in Lockerbie a gas contingent guarantee rate has been imposed for a considerable number of years.

The annual accounts of the Committee on Electricity to the Corporation of Glasgow, which were adopted by the Town Council last week, on the motion of Mr. J. W. Stewart, the Convener, stated the gross revenue to have amounted to £253,402, and the expenditure to £115,317—leaving a balance of £138,085. Out of this sum, the Committee had to meet: Interest on loans, £54,715; sinking fund, £32,308; and depreciation, £50,152. This left a surplus on the year's working of £910, which has been transferred to the credit of the reserve fund account, which now stands at £22,125. The increase of income from all sources was £28,557, while the working expenditure only increased by £9081, which was principally due, apart from the larger output, to the higher price paid for coal. The valuation of the undertaking amounts to £91,039. Capital expenditure during the year amounted to £147,799, and the total capital expenditure, less depreciation written off, amounted, at May 31, to £1,685,084. The quantity of current sold to private consumers was 31,087,322 units. Of the current sold, 6188 units were at 8d. per unit; 10,185,395 units at 3½d. per unit; 213,398 units at 3d. per unit; 5,946,017 units at 1½d. per unit; 5,532,349 units at 1d. per unit; and 9,203,975 units at ¾d. per unit. The number of consumers at May 31 was 16,926, as compared with 15,497 a year previously—an increase of 1429, or 9·22 per cent.

Castlewellan Water Supply.—At the last meeting of the Downpatrick District Council, notification was received from the Public Works Commissioners of Ireland to the effect that the Lords Commissioners of His Majesty's Treasury had sanctioned a loan of £4000 to the Council for the purpose of providinga water supply for Castlewellan. The loan is to be repaid in thirty years, with interest at the rate of 3½ per cent. per annum: and it will be issued to the Council in four instalments of £1000. Five tenders were received for the execution of the scheme; and that of Messrs. Fleming Bros., of Portrush, at £2941 8s. (the lowest), was accepted.

Incandescent Gas Lighting at Castle Donington.—At the meeting of the Castle Donington District Council last Thursday, the Chairman (Mr. L. Stevenson) stated that the Draycott Gas Company had recently submitted proposals for the public lighting of the town from Sept. 12, 1908, to April 11, 1909. They provided that the Company should undertake the entire management of the public lighting; the lamps to be lighted from one hour after sunset until half-past ten every night; and the whole of the service throughout the town to be fitted upon the incandescent system. The initial cost would be £1 10s. 8d. per lamp; but as this included the expenditure necessary to bring the service up to the proper standard of efficiency, the Company hoped to be able to make a reduction next year to the extent of 4s. per lamp. The public lamps would be lighted for 212 nights. The Chairman added that the Company had undertaken to provide an improved lighting service at a smaller cost; and he believed that in the terms submitted they had fulfilled their pledge. It was unanimously decided that the terms proposed should be accepted.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 29.

There has been a fair amount of demand, but supplies have been rather more plentiful, and prices, on the whole, have been slightly in favour of buyers. The closing quotations are £11 7s. 6d. per ton f.o.b. Hull, £11 10s. to £11 11s. 3d. per ton f.o.b. Liverpool, and £11 12s. 6d. to £11 15s. per ton f.o.b. Leith. There has been less doing for delivery ahead; the firmness of makers discouraging buyers. For October-March £12 per ton, and for January-April £12 2s. 6d. to £12 5s. per ton, according to port, are the quotations at the close.

Nitrate of Soda.

This article is quiet in all positions, and the spot prices remain at 10s. per cwt. for 95 per cent, and at 10s. 3d. for refined quality.

Tar Products. LONDON, *Aug.* 31.

The markets are still quiet all round except creosote, which in most quarters remains steady. Pitch is quiet. London makers are out of the market for the present, but sales are again reported on the east coast at 17s. 6d. In Manchester and Liverpool, no sales are announced; but in Scotland good prices have been paid for prompt delivery. Creosote is firm, and business has taken place in London at 2⅝d. for prompt; but 2¾d. has been accepted for delivery to the end of the year. In the Midlands, 2⅝d. has been paid; and in Yorkshire, 2¼d. In Manchester, a fair quantity has been done at 2½d. Benzol is very quiet. In London, 7d. has been accepted, and 6½d. in the North. Benzol, 50-90 per cent., and toluol are neglected. Solvent naphtha is quiet but steady at 10d. to 10½d. per gallon London, and 9d. in the North. For high-flash naphtha, there is little demand just now. Carbolic is dull, and prices have broken badly. London makers are unable to obtain more than 1s. 3d. to 1s. 3½d. for delivery to the end of June. In Manchester, 1s. 2½d. has been accepted for 60's, and 1s. 1½d. for 50's. For prompt delivery, business seems impossible. In napthalene, there is no change reported, and orders are scarce. No business is possible in salts except at prices which are no inducement to makers, owing to the demand for creosote.

The average values during the week were: Tar, 11s. 6d. to 15s. 6d., *ex* works. Pitch, London, 18s.; east coast, 17s. 6d. to 18s.; west coast, 16s. to 17s. 6d., f.a.s. Benzol, 90 per cent., casks included, London, 7d. to 7¼d.; North, 6½d. to 6¾d.; 50-90 per cent., casks included, London, 7d.; North, 6¾d. Toluol, casks included, London, 7¼d. to 7½d.; North, 6¾d. to 7d. Crude naphtha, in bulk, London, 3¼d. to 3½d.; North, 3d. to 3¼d.; solvent naphtha, casks included, London, 10d. to 10¼d.; North, 9d. to 9¼d.; heavy naphtha, casks included, London, 9¾d. to 10¼d.; North, 8¾d. to 9¼d. Creosote, in bulk, London, 2⅝d. to 2¾d.; North, 2⅝d. to 2⅝d. Heavy oils, in bulk, 2⅝d. to 3d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 3d. to 1s. 3½d.; west coast, 1s. 2½d. to 1s. 2¾d. Naphthalene, £4 10s. to £8 10s.; salts, 37s. 6d. to 40s., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included as well as delivered.

Sulphate of Ammonia.

This article remains in about the same position. The principal London Gas Companies quote £11 17s. 6d. for this year's delivery, and £12 2s. 6d. for the spring of next year. Outside London makes remain at £11 7s. 6d. to £11 8s. 9d.; Hull, £11 6s. 3d. to £11 8s. 9d.; and Liverpool, £11 8s. 9d. In Leith, £11 12s. 6d. is about the ruling figure.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a strong demand in the Northern coal trade; but for steam coals the prices are easier, especially where there is a forward delivery stipulated. Best Northumbrian steams are 15s. per ton f.o.b., for immediate delivery; but for forward sales, 14s. 3d. to 14s. 6d. is near current quotation. Second-class steam smalls are 11s. 9d. to 12s. 3d. per ton, and steam smalls from 5s. 9d. to 6s. 9d. There is a full output at the collieries, and it seems to be well taken up. In the gas coal trade, the exports are full, and the home request is heavier than at this time last year; while there is now in progress that growth in the demand usual at this season. Durham gas coals vary in price, and are being quoted from about 10s. 6d. to 11s. 6d. per ton, f.o.b., for ordinary qualities, and up to 12s. for "Wear specials." As to contracts, there are inquiries for some of the Mediterranean ports for next year's shipment, and the tendency of prices is stronger—from 9s. 9d. to 10s. 3d. f.o.b., being looked on as the prices that are likely to be paid for ordinary qualities; but the changes that are possible for freights might affect quotations. Coke is firm; and as gas coke is still rather scarce, the price is relatively high—good gas coke being quoted from about 15s. 9d. to 16s. 6d. per ton f.o.b.

Scotch Coal Trade.

The coal market remains unchanged, though outputs are moving off more freely. The shipping demand is especially good, and, as for some time past, small stuffs are in least request. Steam coal shows no sign of improvement. The prices quoted are: Ell, 10s. 6d. to 12s. 6d. per ton f.o.b. Glasgow; splint, 10s. 9d. to 11s.; steam, 10s. to 10s. 3d. The shipments for the week amounted to 327,891 tons—a decrease of 16,906 tons upon the previous week, and of 1632 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,993,480 tons—a decrease upon the corresponding period of 412,527 tons.

Messrs. J. & T. Alexander, Canmore Works, Dunfermline, have resolved to introduce high-pressure gas lighting into their works. Three hundred lights will be required. The system to be adopted is that of the James Keith and Blackman Company, Limited.

Nottingham Corporation Water Department.

The Nottingham Corporation Water Department were supplying at the end of their last financial year 77,374 houses, and other supplies numbered 56,223; making a total of 133,597. In the Water Committee's report, which will be presented at the next Council meeting, it is estimated that the population of the district to which water is supplied from Nottingham is 348,183. The undertaking had cost up to March, 1907, £1,151,062. Since then £8768 has been spent on new mains, repairs, services, &c.; meters have cost £1065; a further £11,697 has been spent on the Boughton works; £1000 on the Wilford Suspension Bridge; and £448 on the Watnall reservoir. Up to the present, therefore, the Nottingham water undertaking has cost about £1,180,152. Pumping expenses, distribution, &c., amounted during the year to £19,791; salaries to £5611; rates and taxes to £10,570—the total expenditure being £41,714. Water-rents produced £134,619, and other receipts brought the total up to £136,465; leaving a balance of £94,751 carried to the net revenue account. Annuities absorbed £23,345; interest on consolidated stock, £23,031; interest on loans, £1063; and contributions to sinking funds for redemption of stock (£7149), annuities (£2630), and loans (£189), £9968. The balance of £37,163 was transferred to the fund for depreciation renewals (Derwent Water, &c.), which now stands at £72,392.

Harrow and Stanmore Gas Company.—At the half-yearly meeting of the Company next Monday, the Directors will report continued increase in the consumption of gas, and satisfactory progress in every way, in the six months ending the 30th of June. They have been able to complete the purchase of additional land, which will give direct access from the works to the Metropolitan Railway. The accounts show that the receipts were £18,878, and the expenses £13,012; leaving a balance of £5866. A sum of £8765 is available for distribution; and the Directors recommend the payment of dividends at the rates of 10 and 7 per cent. per annum and the addition of £296 to the reserve fund. This will leave £3993 to be carried forward.

The Public Lighting Question at Thetford.—Though the dispute in regard to the public lighting of Thetford, to which reference was made in the "JOURNAL" last week (p. 536), has not been definitely settled, it appears that an agreement on all the main points will probably be arrived at. At a meeting of the Urban District Council on Wednesday, correspondence was read from the Gas Company urging that the disputed accounts for last season should be arbitrated upon by an independent gentleman acceptable to both parties. It was proposed to resume the lighting on the 1st of September, on the basis of a contract to May 31, at £2 per lamp, while for the all-night lamps £4 would be charged. A resolution was passed empowering the Mayor (Mr. F. H. Millington) to continue in communication with the Company and endeavour to come to a fair arrangement for further consideration by the Council. The offer of the Company with reference to future lighting was accepted.

Caution to Well-Sinkers in London.

In view of the fact that many water consumers, in order to be relieved of the Metropolitan Water Board's charges, may have attempted to sink wells on their own premises, or be contemplating such action, Mr. George Kebbell recently sent the following letter to a morning paper: "Whilst sympathizing with the efforts of these consumers, I doubt their ultimate success. The process is too much of a gamble. You may find your well yielding satisfactorily, when suddenly your neighbour follows suit, and, having perhaps gone a few feet deeper, dries up your supply. Some twenty years ago, the East London Company sank a well at Waltham Abbey, obtaining therefrom an almost inexhaustible flow of water. But note the effect. Every other well within two or three miles immediately ran dry. About fifty years ago, the old Hampstead Water Company constructed an artesian well at Kentish Town—advised and guided by the most expert geologists and engineers of the time. For two years the sinking went on, until a depth of 1302 feet had been reached, and yet there was no water. Finally, after an expenditure of £7500, the undertaking was abandoned, and the Company became merged in the New River Company. A more remarkable instance was that of the inhabitants of Richmond, who some thirty years ago determined to sink a well in the chalk, and be their own water purveyors. After an expenditure, directly and indirectly, of about £60,000, a hole was bored to a depth of 1334 feet, and a yield obtained of 5¾ gallons of water per minute! Eventually the inhabitants were compelled to make terms once more with the Southwark and Vauxhall Water Company. In fact, the consumer must think twice before sinking a well."

Price of Gas at Preston.—Complaints having been made in regard to the price charged for gas by the Preston Gas Company, the Lighting Sub-Committee of the Town Council recently had an interview with the Secretary of the Company, who advanced several reasons why a reduction could not be made. At a meeting of the Council last Wednesday, Alderman Pearson stated that in 1907 the Company made a profit of £29,901, equal to 1s. 2¾d. per 1000 cubic feet of gas sold. A sum of £27,942 was required to pay the interest and dividends, equal to nearly 1s. 2d. per 1000 cubic feet—leaving the narrow margin of surplus profit of only £1959 to carry forward. A shilling per ton increase in the cost of coal was equal to £1875 for the quantity consumed last year. It had been said that the Corporation should acquire the gas-works; but if they did this they would have to find sufficient capital to provide not only the same amount of dividends, but most probably other compensations. The Corporation could not possibly manufacture gas more cheaply than the Company, nor could they manage the concern with greater economy. The purchase of the undertaking, involving the provision of so much capital, with the additional infliction of a sinking fund, would postpone almost indefinitely any hope of the inhabitants getting cheaper gas.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 566.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 10	10	Alliance & Dublin 10 p.c.	19½–20¾	+⅛	4 17 6
268,324	10	,,	7	Do. 7 p.c.	13¾–14½	+⅛	4 16 6
310,000	Stk.	July 15	4	Do. 4 p.c. Deb.	99–102	..	3 18 5
800,000	5	May 29	6½	Bombay, Ltd.	6–6¼	..	5 0 0
40,000	5	,,	6½	Do. New, £4 paid	4¼–4⅜	..	5 9 6
50,000	10	Aug. 27	14	Bourne-mouth Gas and Water	10 p.c.	..	4 16 6
					B 7 p.c.		
51,810	10	,,	7		Pref. 6 p.c.	16–16¾*	.. 4 4 9
53,200	10	,,	6				
380,000	Stk.	Aug. 13	12½	Brentford Consolidated		15–16⅝	+⅛ 3 15 0
300,000	,,	,,	9½	Do. New		242–247	.. 5 1 3
50,000	,,	,,	5	Do. 5 p.c. Pref.		180–185	.. 5 2 8
206,250	,,	June 12	4	Do. 4 p.c. Deb.		120–125	.. 4 0 0
220,000	Stk.	Mch. 12	10¾†	Brighton & Hove Orig.		100–103	.. 3 16 2
246,320	,,	,,	7¼†	Do. A. Ord. Stk.		210–215	.. 5 0 0
460,000	20	Mch. 27	10	British		154–159	.. 4 17 6
109,000	Stk.	Aug. 27	6	Bromley, Ord. 5 p.c.		41–43	.. 4 13 0
165,700	,,	,,	4½	Do. do. 3½ p.c.		113–117*	.. 5 3 5
500,000	10	May 14	7	Buenos Ayres (New) Ltd.		84–86	.. 5 4 8
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.		112½–113½	+½ 5 19 2
150,000	20	July 15	7½	Cagliari, Ltd.		92–94	+1 4 5 1
100,000	10	—	—	Cape Town & Dis., Ltd.		4–6	.. —
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.		5–7	.. 6 8 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.		48–50	.. 6 0 0
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.		78–83	.. 5 8 5
157,150	Stk.	Aug. 13	5	Chester 5 p.c. Ord.		108½–110½	.. 4 12 7
1,491,280	Stk.	Aug. 27	5⅛	Commercial 4 p.c Stk.		105–11	+⅛ 4 14 6
560,000	,,	,,	5	Do. 3½ p.c. do.		101–103*	.. 4 17 1
475,000	,,	June 26	3	Do. 3 p.c. Deb. Stk.		81–83	.. 3 12 3
800,000	Stk.	June 12	6½	Continental Union, Ltd.		110–115	.. 5 13 1
200,000	,,	,,	7	Do. 7 p.c. Pref.		137–142	+1 4 18 7
460,170	Stk.	—	5	Derby Con. Stk.		122–124	.. 4 0 8
55,000	,,	—	4	Do. Deb. Stk.		103–105	.. 3 16 2
148,995	,,	Mch. 31	5	East Hull 5 p.c. Ord.		100–103	.. 4 17 1
486,090	10	July 15	12	European, Ltd.		22½–23⅝	.. 5 2 2
354,060	10	,,	12	Do. £7 10s. paid		16½–17½	.. 5 2 10
15,181,590	Stk.	Aug. 13	4/12/8	Gas-light and Coke	4 p.c. Ord.	97–99	.. 4 11 7
2,600,000	,,	,,	3⅜		3½ p.c. max.	86–89	.. 3 18 8
3,799,735	,,	,,	4		4 p.c. Con. Pref.	104–107	.. 3 14 9
4,193,975	,,	June 12	3		3 p.c. Con. Deb.	85–87	+1 3 8 11
258,740	Stk.	Mch. 12	4¾†	Hastings & St. L. 3½ p.c.		93–95	.. 4 16 11
82,500	,,	,,	1¼†	Do. do. 5 p.c.		112–115	.. 5 8 8
70,000	10	Apl. 29	12	Hongkong & China, Ltd.		18–19	.. 5 15 9
4,940,000	Stk.	May 14	8	Imperial Continental		180–183	+⅛ 4 7 5
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.		94–96	.. 3 12 11
195,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.		116–120*	+1 5 0 0
551,000	Stk.	Aug. 27	10	Liverpool United A		227–229*	.. 4 7 4
718,100	,,	,,	7	Do. B		163½–165*	.. 4 4 7
306,083	,,	June 25	4	Do. Deb. Stk.		104–106	.. 3 15 6
75,000	5	June 26	6	Malta & Medn., Ltd.		4¾–5⅜	.. 6 6 4
560,000	100	Apl. 1	5	Met. of	5 p.c. Deb.	101–103	.. 4 17 1
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	101–103	.. 4 7 5
541,920	20	May 29	3⅜	Monte Video, Ltd.		11–12	.. 5 16 8
1,775,892	Stk.	July 30	4/12/6	Newc'tle & G'tesh'd Con.		10½–10⅝	–⅛ 4 6 0
418,463	Stk.	June 26	3½	Do. 3½ p.c. Deb.		90–91	.. 3 16 1
15,000	10	Aug. 27	10	North Middlesex 10 p.c.		19½–20½*	+⅛ 4 17 6
55,940	10	,,	7	Do. 7 p.c.		13–14*	+⅛ 5 0 0
300,000	Stk.	Apl. 29	8	Oriental, Ltd.		140–143	.. 5 11 11
60,000	5	Mch. 27	7	Ottoman, Ltd.		6–6½	.. 5 7 8
398,490	5	Apl. 29	7	Primitiva Ord.		5⅝–6⅛	.. 5 12 0
796,980	5	July 30	5	Do. 5 p.c. Pref.		4⅝–5⅛	.. 4 2 6
488,900	100	June 1	4	Do. 4 p.c. Deb.		95–97	.. 4 17 7
1,000,000	10	Apl. 29	8	River Plate Ord.		13½–13⅝	.. 5 16 5
312,650	Stk.	June 26	4	Do. 4 p.c. Deb.		92–94	.. 4 5 1
250,000	10	Apl. 10	8	San Paulo, Ltd.		13½–14	.. 5 14 4
125,000	50	July 1	5	Do. 5 p.c. Deb.		49–51	.. 4 18 0
135,000	Stk.	Mch. 12	10	Sheffield A		245–246	.. 4 1 4
209,984	,,	,,	10	Do. B		244–246	.. 4 1 4
523,500	,,	,,	10	Do. C		243–245	–1 4 1 8
70,000	10	May 29	10	South African		13–14	.. 7 2 10
6,429,895	Stk.	Aug. 13	5/16/8	South Met., 4 p.c. Ord.		118–121	.. 4 8 1
1,895,445	,,	July 15	⅜	Do. 3 p.c. Deb.		8,–86	+1 3 9 9
209,820	Stk	Mch. 12	8	South Shields Con. Stk.		156–158	.. 5 1 3
605,000	Stk.	Aug. 13	5/6/8	S'th Suburb'n Ord. 5 p.c.		113–116	.. 4 9 7
60,000	,,	,,	5	Do. 5 p.c. Pref.		117–122	.. 4 2 0
117,058	,,	July 15	5	Do. 5 p.c. Deb. Stk.		120–125	.. 4 0 0
502,310	Stk.	May 14	5	Southampton Ord.		108–113	.. 4 8 6
120,000	Stk.	Aug. 13	6¾	Tottenham and Edmonton	A 5 p.c.	117–122	.. 5 10 8
398,940	,,	,,	5¼		B 3½ p.c.	105–108	.. 4 17 3
149,470	,,	June 25	4		4 p.c. Deb.	100–105	.. 3 16 2
182,380	10	June 12	8	Tuscan, Ltd.		10–10½	.. 7 12 4
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.		59–61	.. 4 19 0
193,742	Stk.	Aug. 27	5	Tynemouth 5 p.c. max		104–105*	+½ 4 15 3
255,636	Stk.	Aug. 27	6½	Wandsworth and Putney	B 3½ p.c.	124–129*	.. 5 0 9
79,416	,,	June 26	3		3 p.c. Deb. Stk.	73–78	.. 3 16 11
845,872	,,	Aug. 27	5⅜	West Ham 5 p.c. Ord.		99–102*	+⅛ 5 0 6
185,000	,,	,,	5	Do. 5 p.c. Pref.		118–123*	+⅛ 4 1 3
228,300	,,	June 26	4	Do. 4 p.c. Deb. Stk.		100–105	.. 3 16 2

Prices marked * are "Ex div." † Next dividend will be at this rate.

Halifax Corporation Reservoir Leakages.—The Engineers of the Halifax Corporation reservoirs at Walshaw Dean believe that the source of the leakage at the lower reservoir has been discovered. Water rises rapidly in the shaft, which has been sunk to a depth of 128 feet, and they are now of opinion that the escaping water comes through a fault in the hillside behind the formation of the lower reservoir. The Water Committee will consider at their next meeting how the matter shall be dealt with, and also what steps shall be taken to stop a leakage at the Roiles Head reservoir which has existed for some time.

Profit-Sharing in Boston (Mass.).—Of the 6086 preferred stockholders of the Massachusetts gas companies, 650 are employees of the Boston Consolidated Gas Company under the profit-sharing system introduced two years ago, at the time the sliding-scale was adopted. Under the terms of the scheme, any person who has been in the employ of the Company for one year or more, who is of good habits, faithful, energetic, and honest, is paid the same premium or dividend on the amount of his compensation that the stockholder receives as dividend on his investment; and as the Company paid 8 per cent. on their stock for the financial year ending the 30th of June, the employees received an addition of 8 per cent. to their salaries or wages. Every employee is eligible as a profit-sharer; and in the past year the Company paid about $45,000 in premiums.

Maidstone Water Company.—At the recent half-yearly meeting of the Maidstone Water Company, the Chairman (Mr. W. H. Bensted), before moving the adoption of the report, referred in feeling terms to the great services rendered to the Company by the late Chairman (Mr. H. W. Tyrwhitt Drake), whose death was recorded in the "JOURNAL" for the 18th ult.; and it was decided to send to Mrs. Drake a letter of condolence with herself and her family in the great loss they had sustained. Passing on to the business of the meeting, the Chairman moved the adoption of the Directors' report, which showed that for the six months ending on 30th of June the water-rents amounted to about £6779; being an increase of £62 compared with the corresponding period of last year. The sum of £8039 stood to the credit of the profit and loss account; and the Directors recommended the payment of a dividend, free of income tax, for the half year, at the rate of 7½ per cent. per annum on the 10 per cent. shares; and at the rate of 5¼ per cent. per annum on the 7 per cent. shares. These payments would absorb £1680; leaving £6359 to be carried forward. The Auditor (Mr. Drew) having made his usual statement regarding the accounts, the report was adopted. With reference to the works, the Chairman explained that a visit of inspection was made on the 18th ult. by Dr. Sims Woodhead, with Dr. Pye Oliver. The former, in a summary of his report, said he considered the Company's gathering-grounds, springs, and water-works were most efficiently and effectively worked; while at each visit he had made he had found the Engineer and Manager (Mr. W. J. Ware) and his working staff had carried out some slight improvement. Dr. Pye Oliver was also exceedingly satisfied with the result of his inspection. The proceedings closed with the customary votes of thanks.

Large Gas-Cooking Outfit in Quebec.—At the recent celebrations in Quebec, meals were prepared for about 2500 persons in a temporary gas kitchen fitted up by the Quebec Gas Company. The equipment consisted of eight gas-ranges side by side, eight hot-plates for a warming-table and 24 under the four ovens. These ovens were 6 feet long, 2 feet high and 2 feet deep, divided into three ovens (24 inches square) each; making a total of twelve ovens, and totalling 24 feet in length. Each oven had two shelves. The coffee and tea urns were made to hold about 75 gallons each, and were kept hot by a gas-burner. During the ten days over which the celebrations extended, the appliances used 89,000 cubic feet of gas. The ranges were rented at $5 for the whole time. The Superintendent of the Commercial Department of the Company (Mr. E. J. L. Esperance) reports that their enterprise astonished the natives; more especially the fact that they went after the business.

Escaping Gas at Acton.—In his annual report, the Chief Sanitary Inspector for Acton states that in two or three parts of the district he received complaints of smells of gas in houses, notwithstanding that gas was not supplied to them. On inspection, he found that gas was getting into the sewers and thence into defective drains under the houses. At Acton Green, where a chemical tester had been inserted in the house drain, an explosion occurred, fortunately doing no damage, but simply blowing off the manhole covers to the sewer and inspection chambers. The Brentford Gas Company were communicated with, and it was found that a collar on their main running through the District Council's sewer manhole was broken, allowing a leakage to take place. This was immediately remedied. In High Street it was impossible to find the cause of the smell of gas in the sewer; and, notwithstanding the assistance of the Public Analyst, it could not be proved whether it was coal gas or vapour given off from petrol or naphtha. The Sanitary Inspector expresses the opinion that it was coal gas.

New Water Supply for Oldham.—The Oldham Corporation have for some years been considering an extension of the water supply, and from the statement made at a recent meeting of the Town Council it is probable that in the near future the borough will have an additional source of water. Alderman Johnson, the Chairman of the Water Committee, moved that the corporate seal be affixed to an agreement between Messrs. Platt Bros. and Co., Limited, and the Corporation in reference to a supply of water from pit shafts at Butterworth Hall, Milnrow. He said the colliery workings in connection with this pit were almost worked out, and the water had been analyzed many times and found to be of the purest quality and suitable for domestic supply. Under the present scheme, they would obtain 750,000 gallons a day. Another section would be available during the next two or three years, when the supply would be augmented to a million gallons daily; and when the coal measures in connection with the Jubilee Collieries were exhausted, they would have an available supply exceeding 2 million gallons a day. The estimated cost in connection with Butterworth Hall was £23,899. The proportional cost would be 4¾d. per 1000 gallons. It was decided to affix the seal to the agreement.

Hard Water No Drawback.

THE NEW AUTOMATIC "RAPID" (No. 1908) CIRCULATING BOILER marks a big step towards securing a high and regular Summer Consumption.

The usual objection brought against boilers of this type where hard water is used is absolutely squashed. The fear that the circulator may become furred up is minimised, owing to the method of construction specially employed.

Servants cannot waste the consumer's gas, for the Automatic Device—sensitive, reliable, and uncomplicated—cuts down the supply when the burner has done its work.

We are anxious that you should inspect and test a sample "Rapid" without delay.

DAVIS—the Gas Stove People.

CAMBERWELL, LONDON, S.E.

Motor Lorry Traffic and Gas and Water Mains.—The frequent damage to gas and water mains occasioned by the increased heavy motor lorry traffic over Barnstaple Bridge has become a matter of concern to the companies involved; and Mr. Charles Hawksley, who has been consulted on the subject, recently inspected the bridge with a view to advising on the matter of diverting the mains. The damage to the pipes causes the surface of the bridge to be disturbed every time a repair is effected, and the matter is one which is becoming most serious. Along the bridge itself it is possible that by placing the mains under the footpath, further damage may be avoided; but the change cannot be effected without considerable outlay.

Further Powers for the Derwent Valley Water Board.—The Derwent Valley Water Board have decided to promote next session a Bill for the following purposes: To extend the periods fixed for the completion of the Howden and Derwent reservoirs, and for the purchase of lands authorized to be acquired for the construction of the Hagglee, Ashopton, and Bamford reservoirs, &c.; to obtain powers to construct through private lands the second and third lines of the portion of the aqueduct, of which the first line is being constructed along the road in the village of Holloway; to postpone the commencement of the sinking fund (now engaged to be begun, upon the expected completion of the works, at the end of ten years from Dec. 31, 1899) until the actual completion of the works and their being brought into remunerative use, such extension not exceeding five years, and to extend accordingly the total number of years for repayment of moneys borrowed; and to obtain power to charge interest out of capital (which also at present ceases, on the expected realization of revenue, at the end of ten years) for an extended period similar to that above specified.

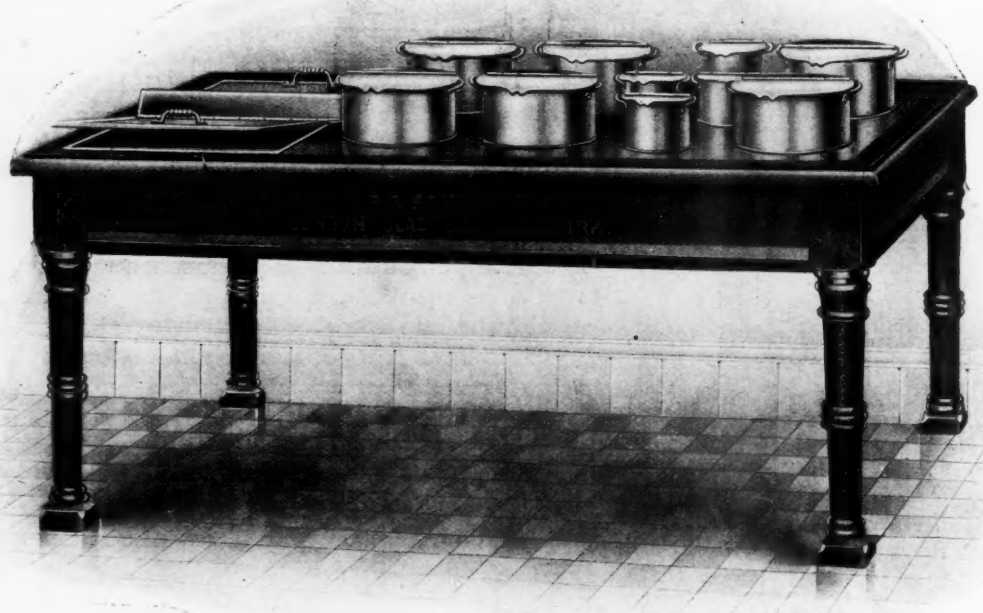
Proposed Water Board for Carmarthenshire.—A special meeting of the Carmarthenshire County Council was held at the Carmarthen Shire Hall a few days since—Mr. Tom Jones, of Llanelly, presiding—to confer with representatives of district authorities respecting the promotion of a Bill for the formation of a Water Board next year. Mr. John Johns strenuously opposed saddling districts which were not interested directly. He said they had already had to contribute towards £1000 expenses incurred. If there was to be a Water Board formed, those who were mainly concerned should bear the expense. It came out in discussion that Ammanford and Llandilo had a good water supply, and that the Carmarthen Union had arranged with Llandilo for the future. As to what should be done on behalf of the Burry Port and Llanelly Rural District Councils, representatives of various bodies were asked to express an opinion. This having been done, Mr. Johns proposed that the Council should have nothing to do with the formation of a Water Board. Mr. W. N. Jones thought the Council ought not to pass a definite motion not to support a Water Board; and he submitted an amendment that the matter should be referred to a Special Committee. Mr. Mervyn Peel seconded the amendment; remarking that the Council would be making themselves a laughing-stock, not only to the county but to Wales, if they let the matter drop. After discussion, the original proposition was carried.

Proposed Supply of Severn Tunnel Water to Cardiff.—As the result of the communication sent to the Great Western Railway Company by Mr. C. H. Priestley, the Water Engineer to the Cardiff Corporation, on a subject of a supply of water from the Severn Tunnel for Cardiff, to which reference was made in the "JOURNAL" last week (p. 532), an arrangement was come to for a meeting between Mr. Priestley and one of the Company's engineers at the end of last week to discuss the matter; but no definite intimation has been given that the Company are prepared to guarantee a continuous supply.

Further Extension of Co-Partnership.—The Chairman of the Walker and Wallsend Union Gas Company (Colonel T. Crawford) has explained to the men employed by the Company the co-partnership scheme proposed to be adopted by the Directors, to which reference has already been made in the "JOURNAL." The scheme, which will come into operation from the 1st of July, provides that a bonus will be granted to all officials and workmen, to be calculated on their ordinary salaries and wages, exclusive of overtime, and subject to the Company's sliding-scale system. The Directors propose to take the same standard price as that governing dividends—3s. 2d. per 1000 cubic feet—and for every 1d. the price is reduced below this, a bonus equal in amount to 10s. per £100 on the annual amount of salary or wages will be paid to each officer and workman. The price of gas at present being 2s. 6d., or 8d. below the standard, gives a bonus of £4 per cent. The total amount of bonus will be paid to each employee as shares in the Company, upon which dividend will accrue, payable in a similar manner to that followed in the case of the present shareholders of the Company. At the same time, a savings bank is incorporated with the scheme, in which any employee may invest any savings, at interest, with the Company, or to be added to his bonus and be invested in shares.

Rating of the Thirlmere Estate.—At the meeting of the Water Committee of the Manchester Corporation on Aug. 20, it was reported that an agreement had been come to between the Corporation and the Assessment Committee of the Cockermouth Union as to the net annual value of the Thirlmere Estate within the area of the Union. The difference between the two bodies has been of long standing. In 1896 the net annual value was allowed at £3500, though the Assessment Committee had sought to have it put at £4761. In 1898, Mr. Hedley was called in by the Rating Authority, and he put the amount at £5400. Thereupon the Water Committee agreed to pay on a net value of £4450, stipulating at the same time that there should be no further increase unless the Manchester Corporation made substantial alterations. Two years ago there was a fresh valuation by Mr. Hedley, with the result that the net annual value of the estate was raised to £8500. The Corporation protested against this increase as unjust and contrary to the agreement made eight years earlier. They said that, so far from having made any "substantial" alterations, they had spent £869 only on improvements. For the sake of peace, however, the Manchester people were willing that the value should be raised to £5500. Each party objected to this, and there was a prospect of costly litigation on the subject; but all trouble has been avoided by an agreement that the sum shall be £6000.

LARGE POLISHED COPPER
"BAIN MARIE."



FOR HOTELS,
RESTAURANTS, &c.

R. & A. MAIN, LTD.
LONDON GLASGOW, FALKIRK.

Gas-Works Extension at Leigh-on-Sea.—At a special meeting of the Leigh-on-Sea Urban District Council last Tuesday, the Gas Committee reported that, in view of the heavy capital commitments consequent on the extensions being carried out at the gas-works, it would be necessary to raise a further loan of £3000 in addition to the £1000 recently authorized. With this object they had been in communication with a private gentleman, who stated that he was prepared to advance this sum next month possibly at the rate of £3 15s. per cent., and certainly not higher than £3 16s. 9d. per cent. The Committee recommended that the Assistant-Clerk be authorized to accept the offer, and endeavour to obtain the money at the lower rate. After some discussion, however, the matter was referred to the Finance Committee, with power to act.

Lymington Water Supply.—The water question at Lymington, in which much interest is being taken locally, assumed a new and important phase last Thursday, when the announcement was made that Messrs. Isler, who have been carrying out boring operations at Ampress during the past few weeks, had reached water. The actual depth bored was 348 feet; and so plentiful was the supply that the water rose 5 feet above the ground. The news of the finding of water was hailed with great jubilation in the town, which has hitherto obtained a large portion of its supply from land belonging to Mr. Pember, K.C., at Ampress, at a rent of £1 per annum. According to a local paper, he recently demanded £100 per annum for a continuance of the supply. After much discussion, the Town Council refused to enter into any such arrangement; and Mr. Pember has now issued a writ for an injunction and damages.

Water-Works in the Argentine.—A British Consular report lately issued on the trade of the district of Rosario, chronicles the execution of important improvements in connection with the Rosario Water-Works, which are in the hands of a British Company. A new 30 inch main has been laid, at a cost of £25,000, from the pumping-station to the town, and larger pipes have been substituted for 3-inch ones; while in the suburbs 27,500 yards of new piping has been laid. The sand filters have been increased; bringing up the filtering capacity to 7 million gallons per day. A new engine, capable of raising 166,000 gallons per hour, has been brought into use. The pumping power of the combined engines is now 650,000 gallons per hour. Some idea of the growth of the town may be gathered from the fact that the Water Company connected 1500 new buildings, principally dwelling-houses, during the year covered by the report.

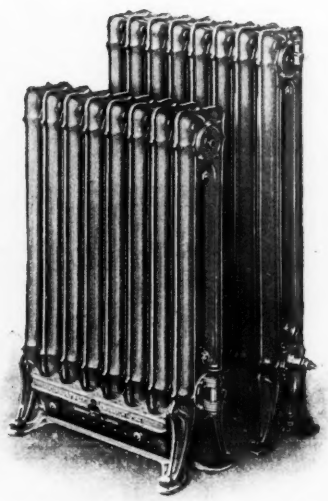
Water Supply in the Monmouthshire Valleys.—A conference of representatives of places in the Monmouthshire Valleys was held at Newport last Wednesday—Alderman P. W. Raffan presiding—to consider a proposal to establish a Water Board for the Sirhowy and Western Valleys, necessitated through the failure of the Monmouthshire County Council to get through Parliament their Bill for the better supply of these districts with water; the present service being quite inadequate. Communications were read from the Tredegar and Ebbw Vale District Councils, who are standing out of the project; and in view of the nature of these communications, the conference considered it desirable to obtain further information from both of these authorities with regard to their position before finally deciding on the action to be taken. It was therefore resolved to ask the Councils to receive a deputation from the conference.

Damage to the Bradford Water-Works by Storm.—As the result of a remarkable cloud-burst which took place at the beginning of June, over a portion of Wharfedale, serious damage was done to the two water reservoirs of the Bradford Corporation on Barden Moor, which were right in the track of the storm. Within a limited area, as much as 4·06 inches of rain fell in an hour and a half. The locality was visited last Friday by some members of the Water Committee, who were conducted by the Water Engineer (Mr. James Watson). No accurate estimate can yet be formed of the cost of repairing the damage, but it will probably be very nearly £5000. In the lower reservoir about 16,000 cubic yards, or about 30,000 tons, of material must be removed; while at the upper one, some 8000 or 10,000 tons will require to be dealt with. Men are now engaged on the work; but it will be some months before the damage can be made good.

A "No. 99, Cannon Street" Project Discouraged.—That the publicity given in the Press to the doings of the No. 99, Cannon Street people has not been without effect is evident from the following information received from a local correspondent: "The Water-Works, Lighting, and Power Investment Corporation, Limited, recently obtained permission from the Barnstaple Rural District Council to open the roads at Braunton with the view of furnishing a supply of gas—the village having been lighted up to the present time with oil-lamps. In the course of a long discussion on the subject in the Braunton Parish Council, the Chairman (Mr. T. Yeo) produced several cuttings from prominent papers advising the Council to weigh the matter most carefully, and strongly urging them not to take a leap in the dark. The Council unanimously decided to inform the Company that they could not give any encouragement or assistance to the proposal, and agreed that the offer to erect the works should be withdrawn."

Water Supply on the Rand.—In the third annual report of the Rand Water Board, it is stated that the supply of water available from all sources on March 31, 1907, amounted to about 5½ million gallons daily. This figure was gradually increased during the year as the development of the boreholes in the Klipriver Valley proceeded. On March 31 last there was an available supply of, approximately, 8 million gallons a day, which will be increased on the completion of the shafts now in progress to about 10 million gallons, the total quantity which the Board are allowed to take from the dolomite formation. As far as can be foreseen at present, the latter quantity will be more than sufficient to meet for years to come the normal demands of the mines and municipalities within the area served by the Board. The sale of water during the year 1907-8—viz., 2,692,488 gallons daily—fell short of the quantity estimated by 257,512 gallons a day, and by 104,520 gallons of the average daily consumption for the previous financial year.

RICHMOND'S



"MONARCH"

GAS-STEAM RADIATORS.

THE SECRETARY, DANYGRAIG CONGREGATIONAL CHURCH, SWANSEA, writes:—

"Last winter we ordered from you 7 Radiators to be fixed in our Church, and I may say they have given **EVERY SATISFACTION.**"

August, 1908.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.

London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. General Offices and Works: Warrington, &c.

In consequence of the Corbridge Parish Council being unable to come to terms with the Corbridge Gas Company, it is stated that the Council contemplate lighting the streets, &c., with petrol, a trial of which is about to be made.

The Ilford Gas Company have renewed for the third time in succession, and for a further period of years, their contract with the Richmond Gas Stove and Meter Company, Limited, for the supply of both prepayment and hired gas-cookers.

As the result of a special resolution passed by the shareholders, a petition has been presented to the Chancery Division of the High Court of Justice to reduce the capital of the Gas Desulphurization Company, Limited, from £15,100 in £10 shares, to £3020 in £1 shares.

The Directors of Stewarts and Lloyds, Limited, have declared interim dividends for the half year ending the 30th of June at the rate of 6 per cent. on the preference shares and 9 per cent. on the ordinary shares. The interim dividend paid on the ordinary shares a year ago was at the latter rate.

The Carron Company have sent us a copy of their catalogue of their new season's gas-fires. It contains a collection of attractive designs which will appeal to the most refined and exacting tastes. Every modern improvement is embodied in these fires, which are made with enamel, bronze, or armour-bright finish. Included in the catalogue are particulars of the Company's gas-heated steam radiators and hygienic induction condensing gas-stoves.

"Help and Economy for the Household" is the title of an attractive little pamphlet which is being issued by the Dover Gas Company. Illustrated particulars are given of lamps for outdoor and interior lighting, and of stoves for cooking and heating, geysers, &c. On the title-page the advisability of saving time in the discharge of domestic duties by the housewife is emphasized; and at the end of the pamphlet there are instructions as to the use of a gas cooking-range.

The Llynvi Valley Gas Company have placed the order with Messrs. Robert Dempster and Sons, Limited, of Elland, for a new retort-house with regenerator settings with all new mountings (to be fitted with Scott and Dempster's patent travelling platform), a rotary exhauster, a Livesey patent washer, a cast-iron tower scrubber, four 15 feet square purifiers with roof, and remodelling all the pipes between the apparatus. The whole of the buildings and foundations are being done by the Contractors, without subletting.

At the London Bankruptcy Court last Tuesday, before Mr. Registrar Hope, Mr. Edward B. Milne, of 15, Craven Street, Charing Cross, and 1, Pocock Street, Blackfriars Road, heating and hot water engineer, attended for his public examination. He had filed accounts showing gross liabilities of £4474 10s. 7d., of which, £4334 8s. 8d. is expected to rank, against assets valued at £340 17s. 6d., after deducting £49 13s. 1d. for payment of the preferential claims. Mr. W. G. Williams, the Assistant Official Receiver, applied for an adjournment, to enable him to investigate the statement of affairs, which had only recently been lodged; and the hearing was postponed for three weeks.

The management of the Prague Water-Works have decided to allot the contract for their new conduit system to the French Pont-a-Mousson Company.

Pintsch's Patent Lighting Company, Limited, have lately enlarged their works at Dover Wharf, Limehouse; and after Monday next their City offices will be at Friars House, New Broad Street, E.C.

The Bens Gas Company, Limited, was recently registered with a capital of £5000, in £1 shares, to acquire the business carried on by Messrs. M. F. & H. Miéville at Chichester, as the Bens Gas Company.

The Directors of the Hardy Patent Pick Company report that the net profit for the year ended June 30 is £12,333, and the profit brought forward from last year £7075; making a total of £19,408. They propose to pay a dividend of 5 per cent. on the ordinary shares, appropriate £1000 for depreciation of plant, &c., and carry £6748 forward. For the previous year, the net profits were £16,257, or £3924 more than in the year just ended; enabling the Directors to make a distribution of 10 per cent. on the ordinary shares.

APPLICATIONS FOR LETTERS PATENT.

17,294.—Harris, W., and Stone, F. R., "Acetylene generators." Aug. 18.
17,296.—Watson, C., "Inclined purifier grids." Aug. 18.
17,316.—Bonniksen, B., and Fletcher, H., Bye-pass nipples for gas-burners." Aug. 18.
17,321.—Cuttell, T. L., and the Anti-Vibration Incandescent Lighting Company, Limited, "Lighting incandescent street and other gas-lamps." Aug. 18.
17,537.—Dixon, C. L., "Gas-heated kettle and burner." Aug. 21.
17,540.—Norman, Sir H., and Reader, T. B., "Light-controlled lighting switch." Aug. 21.
17,572.—Mavor, H. A., and Main, A. P., "Heat radiators." Aug. 21.
17,596.—Unruh, M. von, "Incandescing bodies for gas." Aug. 21.
17,599.—Flowers, S., "Gas-stoves." Aug. 21.
17,603.—Glasgow, A. G., "Manufacture of water gas." Aug. 21.
17,617.—Turner, E. A., "Incandescent bodies or burners." Aug. 21.
17,643.—Blakeley, W., "Hydraulic mains." Aug. 22.
17,647.—Shaw, F., Percy, T. M'L., and Entwisle, J. K., "Doors for retorts." Aug. 22.
17,654.—Hutchins, J., "Distributing valves." Aug. 22.
17,672.—Boyd, H., "Water-softening plant." Aug. 22.
17,675.—Hindrichs, E., "Reflector for inverted lights." Aug. 22.
17,693.—Glasgow, A. G., "Manufacture of water gas." Aug. 22.
17,697.—Barralet, T. E., "Geysers." Aug. 22.

We specialize
in
COOKING APPARATUS
for
Hotels,
Boarding Houses,
Public Institutions,
&c., &c, &c.

YOUR ENQUIRIES . . .
WILL BE ESTEEMED.

THE PARKINSON STOVE CO., LTD.,
Stour Street, Spring Hill,
BIRMINGHAM.

"ILLUMINATING TRUTHS."

LEAFLETS FOR DISTRIBUTION.

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."
No. 7.—"The Osram Lamp: Fiction and Fact."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

CLERK. No. 4986.
MANAGER. Powell Duffryn Company, Aberdare.
REPRESENT METER FIRM. No. 4985.

Situations Wanted.

CHEMICAL PLUMBER AND LEAD BURNER. Davies, Shepherd's Bush.
GENERAL CLERK. No. 4987.
MANAGER OR ASSISTANT. No. 4983.
MANAGER OR MANAGER AND SECRETARY. No. 4982.
WORKING-FOREMAN. H. Bendall, Lavender Hill, S.W.

Correspondence Classes.

LEES, H., Hexham.
CORRESPONDENCE COLLEGE COMPANY, Cambridge.

Plant (Second-Hand), for Sale.

GAS EXHAUSTER. John Adams and Sons, Newcastle.
RETORT BENCH MOUNTINGS, PIPES, &c. Lochgelly Gas Company.

Inventions Wanted.

LIGHTING HEATING, MANUFACTURING, &c. No. 4984.

Stocks and Shares.

EAST HULL GAS COMPANY. Sept. 9.

Patents to Sell or Licences to Manufacture.

IMPROVEMENTS IN GAS-RETORT CHARGING APPARATUS. Haseltine, Lake, and Co., Chancery Lane.
REVIVIFICATION OF FILTERING MATERIAL. Haseltine, Lake, and Co., Chancery Lane.
IMPROVED METHOD OF TREATING COAL FOR COKING PURPOSES. Haseltine, Lake, and Co., Chancery Lane, W.C.
GAS METER. Wheatley and Mackenzie, Chancery Lane, W.C.
CONVEYORS FOR RETORT STACKS, &c. H. Haddan and Co., Bedford Row.
GAS-RETORT CHARGING APPARATUS. H. Haddan and Co., Bedford Row.
ELECTRO-MAGNETICALLY OPERATED VALVES. H. Haddan and Co., Bedford Row.
IGNITING GAS-BURNERS, &c. H. Haddan and Co., Bedford Row.

TENDERS FOR

Exhauster and Engine; Rotary Washer Scrubber; Purifier; Gas-Mains.

MILFORD HAVEN URBAN DISTRICT COUNCIL. Tenders by Sept. 10.

Oxide of Iron.

EDINBURGH AND LEITH CORPORATIONS' COMMISSIONERS. Tenders by Sept. 14.

Pipes.

RAMSGATE CORPORATION. Tenders by Sept. 7.

Coke.

RAMSGATE CORPORATION. Tenders by Sept. 7.

Stores.

BRADFORD CORPORATION. Tenders by Sept. 17.

Sulphate of Ammonia.

ISLE OF THANET GAS COMPANY. Tenders by Sept. 10.

Coke-Conveyor (Repairs and Renewals).

ISLE OF THANET GAS COMPANY. Tenders by Sept. 10.

Tar.

BRADFORD CORPORATION. Tenders by Sept. 17.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

TO Gas Managers, &c., Wanted, Old Condemned GAS-METERS, from 1-light to 1000-light, for destruction to re-claim Metals. Write for Prices, Stating Quantities and Sizes, and if Wets or Drys. Scrap Metals, Drosses, Metal Shop Sweepings, &c., also bought
J. WILSON, Pleasant Grove, York Road, King's Cross, LONDON, N.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
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THE First Dutch Bogore Co., Ltd.,
NYMEGEN, HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON,
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

BENZOL
AND
CARBURINE FOR GAS ENRICHING.

ALSO
THE MAXIM PATENT CARBURETTOR.

For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

"NUGEPE" GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

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SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.

BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

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SPECIALLY prepared for the Manu- facture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD., with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

LUX'S GAS PURIFYING MASS.
See Advertisement on p. 551.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

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SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

DESSAU PATENT VERTICAL RETORTS.
FOR list of Installations, see "Journal," Aug. 25, p. I. of Centre.
THE DESSAU VERTICAL RETORT COMPANY,
Care of Mr. Charles Hunt, Consulting Engineer,
17, Victoria Street, Westminster, S.W.

AMMONIACAL Liquor wanted.
Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.
Telegrams: "Chemicals."

OXIDE OF IRON (BOG ORE)
ANY QUANTITY. ANY PORT. ANY STATION.
DONALD M'INTOSH,
110, CANNON STREET, LONDON.

FIDDES-ALDRIDGE
SIMULTANEOUS Discharging-Charger.
The one Machine which Discharges and Charges at One Stroke.
See Advertisement, Aug. 18, p. III. of Centre.
ALDRIDGE AND RANKEN,
9, Victoria Street, Westminster, S.W.
Telegrams: "Motorpathy, London." Telephone: 5118 Westminster.

AMMONIA.
Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, Exchange Street, Manchester, and 11, Old Hall Street, Liverpool.

PINCHBECK'S Meters and Burglar PROOF STRONG BOX.
See illustrated advertisement, Aug. 18, p. I. of Centre.
Pinchbeck Limited, Adams Place, George's Road, Holloway, N.

AMMONIACAL Liquor wanted.
Brotherton and Co., Ltd., Ammonia Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
Read Holliday and Sons, Ltd., Huddersfield.

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
J. W. & C. J. PHILLIPS, 23, College Hill, London, E.C., and 7, Park Square, Leeds.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "Dacolight London." Telephone: 2336 Holborn.

THE British Bulk Creosote Company,
Borough Road, Weaste, Manchester.

J. E. C. LORD, Ship Canal Tar Works,
Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

THE UNIVERSITY OF LEEDS.
DEPARTMENTS OF FUEL AND METALLURGY AND CIVIL, MECHANICAL, ELECTRICAL, MINING, AND GAS ENGINEERING.
THE whole of these Departments are now housed in enlarged Buildings Specially Equipped for Systematic Instruction in the various branches of Engineering above mentioned.
Prospectus may be had free on Application from the Registrar.
The next Session begins Oct. 5.

TEACHING BY CORRESPONDENCE.
MR. HERBERT LEES is open to prepare Students, by Correspondence, for the "Gas Engineering" and "Gas Supply" Examinations of the City and Guilds of London Institute.
For Terms, &c., Apply to Elvaston Road, Hexham.

THE RECORD OF THE SEASON.
THREE Medals were obtained by our Students at the recent City and Guilds Examinations in Gas Engineering and Gas Supply. New Classes starting at once.
Correspondence College Company, 26, Green Street, Cambridge.

WANTED, Position as Manager, or MANAGER and SECRETARY, of Small Gas-Works (8 to 30 millions), or Gas and Water Works, by the Advertiser, who at present is very successfully Managing Gas-Works. Good Qualifications and Testimonials. Abstainer.
Address No. 4982, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

CHEMICAL Plumber and Leadburner of Thirty Years' Experience. Well up in Sulphate of Ammonia Plant, Quick Repairer, Good References, own Tools, Day or Piecework, Distance no object. Work Guaranteed.
Address John Davies, 23, Anley Road, Shepherd's Bush, W.

ENGINEER, aged 28, seeks Position as MANAGER or ASSISTANT, at Home or Abroad. Honours Gas Manufacture, and Certificated Draughtsman and Chemist. All-round Practical Experience and highest Testimonials.
Address No. 4983, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a Smart Young Man, Age 24, Position as GENERAL CLERK, BOOK-KEEPER, or CASHIER. Nine Years with Gas-Meter and Cooker Firm. Excellent Credentials.
Address No. 4987, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

YOUNG Man seeks situation as Working FOREMAN. Thoroughly understands Manufacture, Distribution, Testing of Coal and Water-Gas. Well up in Fitting, Main and Service Laying, and all kinds of Machinery. Ten Years' Experience.
H. Bendall, 244, Lavender Hill, Clapham Junction, S.W.

METER TRADE.
WANTED, a Smart Young Man to REPRESENT METER FIRM in the West of England. Write, giving full Particulars, Age, Salary required, and when duties could be commenced. All communications shall be treated confidentially.
Apply to No. 4985, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, for Gas Engineer's London Office, YOUNG MAN with Experience in Gas Apparatus, Stoves, Fittings, &c. Shorthand and Typewriting essential.
Apply, by letter only, stating Age, Experience, Salary, &c., to No. 4986, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Manager of Experience for Coke Ovens and Bye-Product Plant.
Apply, giving full Particulars, to Powell Duffryn Company, Aberaman Offices, Aberdare.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

WE have the following New and Over-hauled Second-Hand PLANT FOR SALE:—
Gasholders, 30 ft. by 12 ft. New Steel Tank.
" 35 ft. by 10 ft. Cast-Iron Tank.
" *45 ft. by 12 ft.
" *50 ft. by 16 ft.
" *50 ft. by 15 ft. 4 in. (Two-Lift)
*We can re-erect these in Brick or New Steel Tanks.
8-inch, 9-inch and 10-inch Condensers.
New "Cripps" Washer (8-inch), 150,000, c.f. per day.
Walker's Purifying Machine.
Exhausters and Engines, Single and Combined, 2000 to 60,000 feet per hour.
Cast-Iron Tower Scrubber, 7 ft. diameter, 55 ft. high.
Purifiers, sets 6-fts., 10-fts., 12-fts., and 20-fts.
Plans and Quotations of new Sets.
6-inch to 18-inch Station Meters, Governors, &c.
Tar and Liquor Pumps.
Producer-Gas Plants for 150 to 300 H.P.
Boilers, Tanks, and all requisites for Gas-Works.
Firth Blakeley, Sons, and Company, Limited, Gas Engineers, Thornhill, Dewsbury (Yorks.).

GAS Exhauster, by Bryan Donkin,
London, capacity 30,000 Cubic Feet per Hour, OR DISPOSAL, in First-Class Order and Condition.
Apply John Adams and Sons, Metal and Machinery erchants, Dismantling and Salvage Contractors, Dep., South Street, Newcastle.

FOR SALE—Complete lot of Retort-BENCH MOUNTINGS, HYDRAULIC MAIN, ASCENSION PIPES, Thirteen Self-Sealing RETORT MOUTHPIECES, &c., &c. Capital Condition.
Particulars from J. D. Keillor, Manager, Gas-Works, Lochgelly.

INVENTIONS.
A MANUFACTURING Firm calling upon Gas Companies would be very pleased to hear of any likely INVENTIONS that would interest Gas Companies. Appliances for Lighting, Heating, or for Gas Manufacturing Plant, will be carefully considered.
Kindly write full Particulars to No. 4984, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

CITY OF BRADFORD.
TENDERS FOR STORES.
THE Gas Committee of the Bradford Corporation are prepared to receive TENDERS for the Supply of the following STORES required in their several Departments during a period of one Year ending Sept. 30, 1909.

	Probable Quantity Required.
Wet and Dry Gas Meters.	
Pipes and Castings.	
Wrought-Iron Steam Tubing.	
Best Merchant Iron and Steel,	30 tons.
Charging Shovels,	70 dozen.
Oxide Wiskets,	25 dozen.
Cotton Waste,	60 cwt.
Best Engine Oil,	1500 gallons.
Common do.,	1800 gallons.
Cylinder Oil,	1000 gallons.
Tarred Gaskin,	90 cwt.
Brass Main Gas Cocks,	160 dozen.
Weed Brooms,	72 dozen.
Best Lime,	120 tons.
Copper Lamps,	500.
Lamp Irons,	300.
Sheet Glass (English) for Street Lamps,	21 oz., 9000 sq. feet.
Opal Glass for Street Lamps,	21 oz., 3500 sq. feet.

Form of Tender with any further Information required may be had on Application to Mr. Chas. Wood, Gas Engineer, Town Hall, and Samples may be seen at Mill Street Gas-Works.
The Contracts will be let subject to the Fair Contracts Clauses of the Corporation, which may be seen at the Town Clerk's Offices, and which the accepted Contractors will be required to sign.
Tenders, endorsed "Tender for Stores," to be sent to me not later than Thursday, Sept. 17.
The lowest or any Tender will not necessarily be accepted.
Frederick Stevens,
Town Clerk.
Town Hall, Bradford,
Aug. 22, 1908.

TO TAR DISTILLERS AND OTHERS.
THE Gas Committee of the Bradford Corporation are prepared to receive TENDERS for the Purchase of their Surplus TAR for One Year.
Form of Tender, with any further Information required, may be had on Application to Mr. C. Wood, Gas Engineer, Town Hall.
Sealed Tenders, endorsed "Tender for Tar," to be sent to me on or before Thursday, the 17th of September, 1908.
The highest or any Tender will not necessarily be accepted.
Frederick Stevens,
Town Clerk.
Town Hall, Bradford,
Aug. 22, 1908.

ISLE OF THANET GASLIGHT AND COKE COMPANY.
THE Directors of the above Company are prepared to receive OFFERS for about 40 Tons of Good Grey SULPHATE OF AMMONIA (Guaranteed 25 per cent. Ammonia) made from Brown Acid.
Delivery of the whole quantity to be taken before the 30th of September next.
Further Particulars may be obtained on Application to the undersigned.
The Directors do not bind themselves to accept the highest or any Offer.
Tenders, endorsed "Sulphate of Ammonia," to be addressed to the Chairman, and received at these Offices by Thursday, Sept. 10 next.
Frank A. Winstanley,
Engineer and Manager.
Engineer's Office, Dane Road,
Margate, Aug. 28, 1908.

ISLE OF THANET GASLIGHT AND COKE COMPANY.
THE Directors of the above Company are prepared to receive TENDERS for REPAIRS and RENEWALS to their INDIA-RUBBER BELT COKE CONVEYOR.
Further Particulars may be obtained on Application to the undersigned.
Tenders, endorsed "Coke Conveyor," to be addressed to the Chairman, and received at these Offices on or before Thursday, Sept. 10, next.
The lowest or any Tender will not necessarily be accepted.
Frank A. Winstanley,
Engineer and Manager.
Engineer's Office, Dane Road,
Margate, Aug. 29, 1908.